POST-CLOSURE MONITORING AND MAINTENANCE OPERATIONS MANUAL

FOR THE

SYOSSET LANDFILL
TOWN OF OYSTER BAY, NEW YORK

APRIL 2003

PREPARED FOR:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY - REGION II
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE OPERATIONS MANUAL

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INTRODUCTION

1.1 Remedial Action Description

The remediation of the former Syosset Landfill was performed under two separate operable units. The First Operable Unit (OU1) remediation addressed the on-site remediation while the Second Operable Unit (OU2) remediation addressed potential off-site impacts from the Landfill.

The OU1 remediation was carried out by the Town of Oyster Bay in accordance with the requirements of a Consent Decree entered into between the Town and the United States Environmental Protection Agency (USEPA) in 1990. The OU1 Remedial Action requirements were stipulated in the USEPA's Record of Decision (ROD) for the site published in September 1990. The OU1 Remedial Action consists of the following components.

- Implementing the New York State landfill closure regulations codified at 6NYCRR Part 360, Solid Waste Management Facilities Regulations which includes the construction of a geosynthetic membrane cap on top of the landfill surface. USEPA and NYSDEC have determined that these regulations are relevant and appropriate but not applicable to the Landfill, which was closed in 1975. The final approved cap section consisted of the following components (from top to bottom):

  - 24-inch barrier protection layer;
  - geomembrane (60 mil, High Density Polyethylene);
  - 12 inch gas venting layer;
  - geotextile filter fabric.

- Providing long-term operation and maintenance of the landfill cap, including routine inspection and repair;

- Providing long-term air and groundwater quality monitoring in accordance with the New York State landfill closure regulations;

- Monitoring and maintaining the passive gas venting system installed under a previously implemented response action, including routine inspection and repair;

- Installing an additional passive gas venting system designed so that it can easily be converted to an active system should conversion become a necessary part of the remedy in the future;

- Maintaining the existing boundary fence around the perimeter of the landfill property to continue to restrict access to the landfill; and

- Placing institutional controls on the landfill property to restrict future use of the landfill in order to ensure the integrity of the cap.

The OU2 remediation program was carried out under a Consent Order entered into between the Town and the USEPA in 1986. The OU2 remediation program consisted of a Remedial Investigation to determine the landfill's potential off-site impacts to groundwater and subsurface gas. The OU2 Remedial Investigation Report was prepared by the Town and submitted to the USEPA in January 1996. The USEPA published a Record of Decision in March 1996 for the OU2 remediation program that stipulated the following conclusions and requirements for a "No Further Action Remedy":

- Site-related groundwater contamination is very limited in extent and does not pose any significant risk to human health and the environment;

- Implementation of the OU1 Remedial Action (Capping and Closure Program) will address potential future impacts from the site; and

- The environmental monitoring program that will be performed as part of the OU1 remedy will take into account sampling for both on-site and off-site

groundwater, ambient air and landfill gas which will further ensure that the OU1 and OU2 remedies remain protective of human health and the environment.

Therefore, this Post-Closure Monitoring and Maintenance Operations Manual for the OU1 Remediation Capping and Closure Program will fulfill the monitoring and maintenance requirements for both Operable Units as stipulated in the OU1 and OU2 Records of Decision.

1.2 Remedial Action Construction

The Remedial Action Construction was limited to on-site source control in accordance with the OU1 and OU2 Records of Decision. The Remedial Action was conducted during two construction contracts. The first contract was a Preload Program conducted between November 1995 and August 1996. The Preload Program consisted of (1) placing clean fill surcharge material on-site to achieve primary site settlement prior to cap construction; (2) construction of the site's stormwater drainage system; (3) construction of a portion of the site's passive gas venting system; and (4) construction of the cap subgrade. The second construction contract was a Capping and Closure Program which was conducted between August 1996 and November 1997. The Capping and Closure Program consisted of the construction of the site-wide cap and the completion of the site's passive gas venting system. The as-built construction drawings are contained in Appendix A of this Manual.

1.3 Future Site Uses

The Town's present intention is that, following the completion of the Capping and Closure Program, it will continue to use the site in a manner similar to its use from 1975 to the present. These uses include vehicle parking, highway yard operations, sanitation yard operations, equipment storage, composting and other municipal uses. Three different types of surface treatments have been placed over the site's cap to accommodate these site uses. The locations of the surface treatments are shown on Drawing No. 1 of the As-Built Plans for the Capping and Closure Program (See Appendix A). Asphalt was used in areas identified for vehicle parking and equipment

storage, recycled concrete was utilized in areas designated for composting and materials storage and a vegetative cover was used in buffer areas and areas whose use is currently undesignated. A more detailed discussion of these surface treatments is provided in Section 2.1 of this Manual.

In accordance with the requirements of the site's Consent Decree and the provisions of 6NYCRR Part 360, a certified copy of the Consent Decree was filed with the Nassau County Clerk's office in 1991. Thereafter, each deed, title or other instrument of conveyance for property on which the landfill, or any part of it, is located will contain a notice stating that the property is subject to a Consent Decree and will reference the recorded location of the Consent Decree and any restrictions applicable to the property under the Consent Decree.

1.4 Purpose of This Manual

The purpose of this manual is to provide instructions to operating personnel for site monitoring, maintenance, and reporting following the capping and closure of the Town of Oyster Bay's former Syosset Landfill. In accordance with New York State Regulations (6NYCRR part 360-2.15), these procedures will be followed for a minimum of 30 years following the completion of the Capping and Closure Program.

Specific subjects discussed in this manual include the:

- cover system;
- drainage system;
- groundwater monitoring system;
- landfill gas venting system;
- reporting requirements;
- post-closure monitoring and maintenance costs; and
- post-closure contingency plan.

The Town of Oyster Bay Department of Public Works (TOBDPW) will be responsible for post-closure monitoring and maintenance at the landfill. The TOBDPW offices are located adjacent to the southern perimeter of the landfill at 150 Miller Place, Syosset,

N.Y. The TOBDPW Division of Engineering office can be contacted by telephone at (516) 677-5722.

Unless a contractor is required to perform any task identified herein, TOBDPW personnel and the Town's engineering consultants will perform post-closure monitoring and maintenance work. The post-closure maintenance requirements contained in this Manual should not require a dedicated full time staff. The Town currently has sufficient staffing and equipment capabilities to implement post-closure maintenance tasks. The monitoring and maintenance of each of these systems is discussed in detail in each of the following sections.

1.5 USEPA Periodic Review

The OU1 and OU2 RODs indicate that within five years after the commencement of the Remedial Action, the USEPA will conduct a review of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Furthermore, Section VIII of the site's Consent Decree stipulates that, to the extent required by Section 121(c) of CERCLA, 42 U.S.C. Section 9621(c) and any applicable regulations, the USEPA will review the remedial action at least every five years after it has been initiated to assure that human health and the environment are being protected by the remedial action. If upon such review, the USEPA determines that further response action is appropriate at the site to assure the protection of human health and the environment, then the USEPA may take, or require the Town to take, such additional response action.

Upon completion of each of the reviews, the USEPA will notify the Town of its determination and may order additional response action pursuant to Section 106 of CERCLA, or may take additional response action pursuant to Section 104 of CERCLA, to assure protection of human health and the environment. If the USEPA orders the Town to take additional response action, the Town will have the opportunity to confer with the USEPA on the response action ordered by the USEPA.

SECTION 2

COVER SYSTEM

2.1 Cover System Description

The proposed cover system was constructed at the former Syosset Landfill in accordance with 6NYCRR Part 360 provisions to minimize stormwater infiltration, to vent landfill gases passively, to provide a permanent barrier between the site's fill material and the land surface, and to provide surface cover material compatible with future site uses.

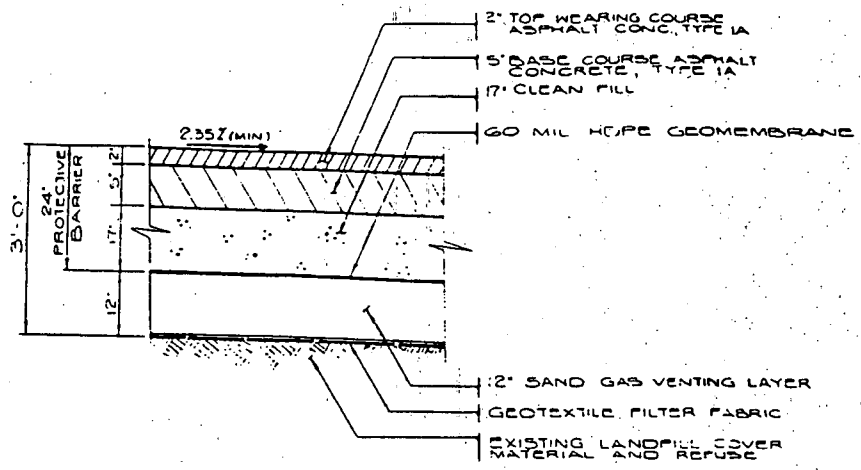
The capping system consists of three types of cap surface treatments over a 60 mil High Density Polyethylene (HDPE) geomembrane and gas venting layer. Details of the cap section are shown in Figure 2-1. Specifically, the cap system contains the following layers (from top to bottom).

- 24-inch barrier protection layer
  - 2" asphalt concrete top course
  - 5" asphalt concrete base course
  - 17" clean fill

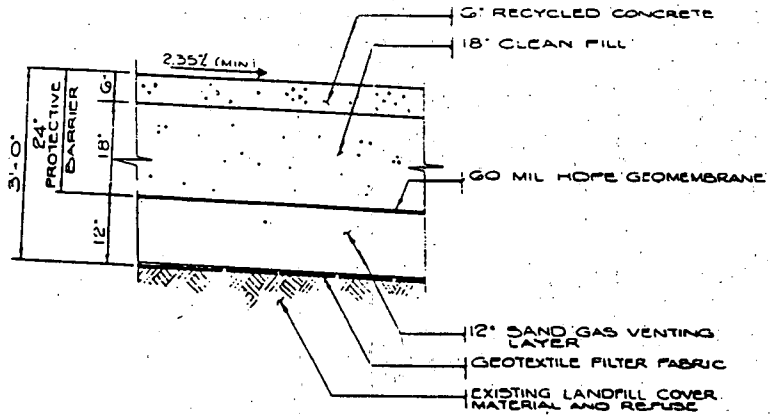
  or
  - 6" recycled concrete
  - 18" clean fill

  or
  - 6" topsoil with a vegetative cover
  - 18" clean fill
- 60 mil HDPE geomembrane
- 12 inch gas venting layer
- geotextile filter fabric

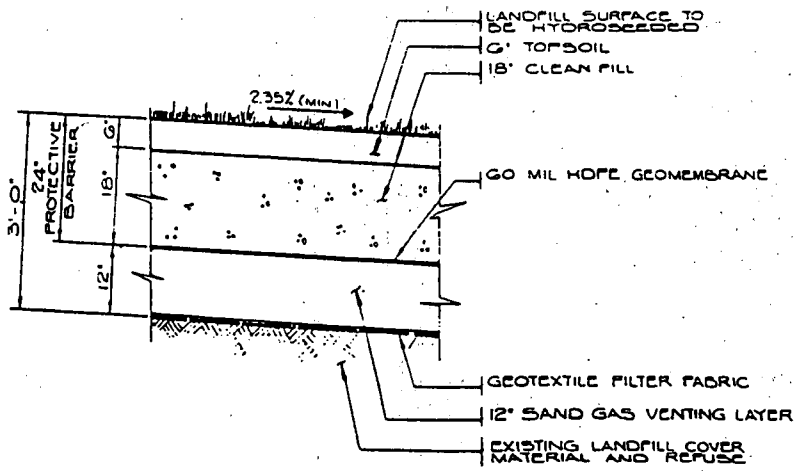
The purpose of the barrier protection layer is to provide sufficient cover material over the HDPE geomembrane in order to protect the geomembrane from damage. The



HDPE GEOMEMBRANE CAP WITH ASPHALT COVER



HDPE GEOMEMBRANE CAP WITH RECYCLED CONCRETE COVER



HDPE GEOMEMBRANE CAP WITH VEGETATION COVER

Figure 2-1

LANDFILL CAP DETAILS

proposed cap section utilizes different cap surface treatments in different areas of the site which are dependent on the site's future uses. The asphalt surface treatment has been constructed in site areas used for vehicle and equipment storage. The recycled concrete surface has been placed in areas utilized for material storage and composting. The vegetative cover surface has been used in buffer areas and areas where the future site uses are undetermined at this time.

The three types of surface treatments will provide protection for the HDPE geomembrane in the following manner. The asphalt and recycled concrete surface treatments will significantly reduce stormwater infiltration into the barrier protection layer and will provide a solid surface for preventing surface intrusion and burrowing animals. The vegetative cover will also reduce stormwater infiltration into the barrier protection layer since the plant material will absorb moisture during the growth cycle.

The 60 mil HDPE geomembrane is a low permeability barrier layer which will significantly reduce stormwater infiltration into the site's fill material thereby minimizing leachate generation.

The gas venting layer beneath the HDPE geomembrane consists of 12 inches of highly permeable sand over a layer of geotextile filter fabric. Since landfill gas is lighter than air, decomposition gases generated in the landfill will enter the gas venting layer, travel to the gas vent wells and will vent to the atmosphere. Venting the landfill gas is necessary to prevent potential off-site gas migration as well as potential damage to the geomembrane cap from stresses caused by gas accumulation under the geomembrane material. The geotextile filter fabric provides separation between the gas venting sand and the clean fill material below to prevent intermingling of the two materials which could cause clogging within the lower portion of the gas venting layer.

2.2 Settlement- Related Impacts to the Cover System

2.2.1 General

Settlement at the former Syosset Landfill was investigated during the Remedial Design phase of the Capping and Closure Program. A summary of the findings of this

investigation was documented in a report entitled "Settlement Study for the Syosset Landfill First Operable Unit Remediation" (1993) prepared by Converse Consultants East for Lockwood, Kessler & Bartlett, Inc.

Site specific settlement data in this study was obtained by placing settlement plates on-site at four locations, applying a surcharge load consisting of ten feet of fill material at these locations and measuring settlement over a six month period. Soil borings were also taken on-site to determine waste settlement characteristics.

The results of this study indicated that settlement at the site would be negligible in comparison to other landfills and that primary site settlement could be achieved in a two to three month period prior to cap construction. Primary settlement is that portion of site settlement caused by imposing a load on the site to create the site's required slopes. Secondary settlement is not load-related and will occur naturally over the post-closure period of 30 years.

Primary site settlement was estimated at proposed cap high point elevations throughout the site to be between two to six inches. Secondary settlement at these locations was predicted to be between 11 inches to 16 inches.

Based on the results of the Settlement Study, a Preload Program was conducted at the site to achieve primary (load-related) settlement prior to cap construction. The purpose of the Preload Program was to obtain primary site settlement that would be caused by the imposition of fill loads over the landfill to construct the cap subgrade and cap section. Obtaining this primary site settlement prior to cap construction would protect the integrity of the cap by not undergoing this settlement after cap construction.

Maximum future site settlement following cap construction (i.e., secondary settlement) is expected to be 16 inches over the 30 year post-closure period. The slopes of the landfill cap were adjusted to accommodate for a relatively uniform secondary site settlement to ensure that a long-term slope of 2% would be maintained after 30 years. For the first three years of the post-closure period, monitoring of potential cap settlement will be performed by a ground survey annually at key cross-sectional locations throughout the landfill. These crossectional surveys will provide an indication

of site settlement during the initial post-closure period for comparison of actual versus predicted site settlement.

Since primary settlement has been achieved through the Preload Program and secondary settlement has been accounted for in the overall site slopes, site settlement should not have a significant impact on the cover system. However, should unanticipated localized areas of differential settlement occur, they should be monitored for potential impacts on the individual components of the cover system. These impacts are discussed in the following paragraphs so that an estimate of acceptable localized differential settlement can be established in order to set guidelines for the cover system maintenance discussed in Section 2.3.

For comparison purposes, the following paragraphs discuss the potential impact on the individual components of the cover system based on achieving the entire 16 inch secondary settlement in the center of a localized area. The general overall landfill dimensions are approximately 2,100 feet long by 800 feet wide, with the landfill high point ridge running lengthwise along the center of the landfill. Localized differential settlement impacts on the various cover system components were investigated assuming the entire 16 inch secondary settlement occurred in the center of areas with a diameter of 100, 50 and 25 feet. These areas were selected based on the overall landfill dimensions, the site-specific waste characteristics and the high percentage of soil material contained within the landfill as identified during the Settlement Study investigation.

2.2.2 Settlement Impacts on the Barrier Protection Layer

Localized differential settlement impacts on the barrier protection layer may cause cracking of the asphalt pavement, and low points in the surface of each of the surface treatments of the barrier protection layer. It is anticipated that should the entire 16 inch secondary settlement occur in a localized area (assume the center of an area with a diameter of 100, 50 or 25 feet), it would not have a significant impact on any of the materials used in these surface treatments and any such impacts should be easily maintained as discussed in Section 2.3.1.

2.2.3 Settlement Impacts on the 60 Mil HDPE Geomembrane

Localized differential settlement impacts on the 60 mil HDPE geomembrane are expected to be minimal. The geomembrane installed within the cover system has an elongation at yield of 12% and an elongation at break of 500%. If a localized differential settlement of 16 inches were to occur at the center of an area with a diameter of 100, 50 or 25 feet, the resulting elongation of the geomembrane would be 0.036%, 0.14% and 0.56% respectively. The magnitude of this range of elongation is substantially less than the geomembrane's allowable elongation of 12% at yield. The deformation (stretching) of the geomembrane to accommodate this distortion should not adversely impact the geomembrane. It is, therefore, anticipated that maintenance of the geomembrane will not be required due to a potential localized differential site settlement of 16 inches. Geomembrane maintenance is discussed in further detail in Section 2.3.2.

2.2.4 Settlement Impacts on the Gas Venting Layer

The gas venting layer is a 12 inch thick layer of highly permeable sand that lies directly below the 60 mil HDPE geomembrane. A localized differential settlement of 16 inches at the center of an area with a diameter of between 25 and 100 feet would not have an impact on the material within the gas venting layer. The uniform sized granular gas venting material will maintain its level of permeability under these differential settlement conditions. It is, therefore, anticipated that maintenance of the gas venting layer will not be required due to a potential localized differential site settlement of 16 inches. Maintenance procedures are discussed in further detail in Section 2.3.3.

2.2.5 Settlement Impacts on the Geotextile Filter Fabric

Localized differential settlement impacts on the geotextile filter fabric are expected to be minimal. The geotextile filter fabric installed within the cover system is a 100% polypropylene, nonwoven, needle punched fabric with a weight of 7.5 oz/cy and a grab elongation of 50%. If a localized differential settlement of 16 inches were to occur at the center of an area with a diameter of 100, 50 or 25 feet, the resulting elongation of the geotextile would be 0.036%, 0.14% and 0.56%, respectively. The magnitude of this

range of elongation is substantially less than the geotextile's allowable elongation of 50%. The deformation (stretching) of the geotextile to accommodate this distortion should not adversely impact the geotextile. It is, therefore, anticipated that maintenance of the geotextile will not be required due to a potential localized differential site settlement of 16 inches. Geotextile maintenance is discussed in further detail in Section 2.3.4.

2.2.6 Maximum Recommended Localized Differential Settlement for Cover System Maintenance

Following a review of potential localized differential settlement impacts on the various components of the final cover system, it is recommended that the maximum localized differential settlement for cover system maintenance purposes be established as 16 inches. Although this amount of differential settlement will not damage any of the cover system components, 16 inches of differential settlement was chosen for maintenance purposes since it represents the maximum amount of anticipated secondary settlement to occur at the landfill. Once 16 inches of localized differential settlement is exceeded, the settlement maintenance procedures discussed in the following section shall be implemented.

2.3 Cover System Maintenance

The following paragraphs discuss the maintenance requirements for each of the individual components of the cover system.

2.3.1 Barrier Protection Layer Maintenance

The cap surface shall be inspected quarterly and after major rainfall events (5-year storms) during the 30-year post-closure period. The barrier protection layer shall be inspected for cracks in the asphalt pavement, surface depressions, vegetative cover growth, erosion in areas of vegetative cover, and indications of site settlement. The results of these inspections shall be recorded as discussed in Section 6, Reporting Requirements.

The results of the barrier protection layer inspections will be of particular significance for tracking the locations and magnitude of potential site settlement. Localized settlements that may cause ponding of stormwater on the surface of the barrier protection layer and potential damage to the cover system components should be avoided. Areas of ponding water will be identified during inspections following rainfall events, recorded and repaired in accordance with the reporting requirements contained in Section 6. Areas impacted by localized differential settlement will have their locations and settlement depths monitored and recorded to ensure that localized differential settlement does not exceed 16 inches at any location.

The following paragraphs discuss the maintenance procedures for each of the three types of surface treatments in the barrier protection layer

2.3.1.1 Asphalt Surface Course

The asphalt surface course will be maintained according to standard practices for asphalt roadway maintenance. Should cracks occur in the surface course that might compromise the integrity of the barrier protection layer, they will be patched following standard procedures. Should large sections of the top course become damaged, they will be removed by saw cutting around the damaged section, removing the damaged asphalt top course and applying a new asphalt top course over the existing base course. Inspection and repair reports shall be completed in accordance with the requirements of Section 6 identifying the locations of the damaged pavement, the description of the repair and the dates of both the inspection and repair.

In areas of localized differential site settlement where stormwater ponding is occurring and the total accumulated settlement has not exceeded 16 inches, the asphalt surface course shall be repaired to ensure that the sufficient slopes are maintained to promote stormwater runoff. The location of the depression, the depth of the depression, the description of repair and the dates of the inspection and repair shall be recorded in accordance with the requirements of Section 6. If this settlement has occurred in an area that has undergone settlement previously, the total accumulated settlement in the area shall also be recorded.

In areas of localized differential settlement where the accumulated settlement is in excess of 16 inches, maintenance of the components of the cover system will be performed as discussed in Section 2.3.4.

2.3.1.2 Recycled Concrete Surface Course

The recycled concrete surface requires very little maintenance. The surface will not crack or wear over time. However, should stormwater ponding occur in localized shallow depressions caused by vehicular traffic or minor settlement (where the total accumulated differential settlement has not exceeded 16 inches), the depressions shall be filled with additional recycled concrete material to ensure that sufficient slopes are maintained to promote stormwater runoff. The location of the depression, the depth of the depression, the description of repair and the dates of the inspection and repair shall be recorded in accordance with the requirements of Section 6. If this settlement has occurred in an area that has undergone settlement previously, the total accumulated settlement in the area shall also be recorded.

In areas of localized differential settlement where the accumulated settlement is in excess of 16 inches, maintenance of the components of the cover system will be performed as discussed in Section 2.3.4.

2.3.1.3 Vegetative Cover Surface

The Town of Oyster Bay has gone to considerable lengths to ensure that the former Syosset Landfill be remediated so that it is both functional as a Department of Public Works facility and aesthetically pleasing to the area around the facility. As part of this remedial effort, the Town of Oyster Bay designed a vegetative cover plan to prevent the soil within the barrier protection layer from eroding, thereby reducing the depth of cover over the HDPE geomembrane. The vegetative cover was also designed to naturally prevent weed growth. Should weed growth occur, the Town will attempt to identify the weeds then take appropriate action to remove the weed growth.

Inspections will occur on a regular basis throughout the entire post-closure period at minimum frequency of four times a year and following major rainfall events (5-year storm). Naturally occurring storms, droughts or landfill settlement may exacerbate the need for maintenance. The vegetative cover will be inspected during or following any of these events. Maintenance will include, as necessary, reseeding, fertilizing, liming, soil repairs, watering and mowing.

In areas where vegetation has not become established or is sparse, reseeding will be necessary. If large areas require reseeding, hydroseeding can be used to apply the seed mix, along with lime, fertilizer, legume inoculant, and mulch in a water mix.

For smaller areas, seed can be broadcast. In this case, the topsoil will be prepared with fertilizer and lime, the seed spread over the area and covered by an application of clean straw or hay mulch. A tacking agent will be used on steep slopes to hold mulch in place.

For best results, seeding will be done from April 1 to May 30, or from August 15 to September 30 using the seed mix specified in the following paragraph. During the planting season, areas that are subject to continuous erosion shall have new topsoil placed (4 inch minimum depth) as required, amended with lime and fertilizer, and seeded.

SEED MIX

	Mixture Tolerance		% Min.	% Min.
Proportions of Mixture	Minus	Plus	Purity	Germination
50% Kentucky 31 Tall Fescue		3%	5%	95% 85%
25% Citation Perennial Rye or Manhattan Perennial Rye	3%	5%	95%	90%
25% Pennlawn Fine Fescue	3%	5%	95%	85%

TOTAL Pure Live Seed (PLS) = 150 lbs/acre.

(The mixture shall have less than 1/4 of 1% weed content and shall be free from noxious weeds)

In lieu of the foregoing seed mix, an alternative but similarly effective mix may be used. Should this seed mix not perform well over the years, then it should be modified to accommodate future conditions at the former landfill.

The year following seeding, top dress with additional fertilizer. Fertilizer in a slow release form will be applied to the cover vegetation to maintain health and vigor without over stimulation of growth. It will be a mix of nitrogen, phosphorus and potassium applied at a rate of approximately one pound per 1,000 square feet. After this period, fertilizer will be applied only as vegetative cover is thinning out or new stands of vegetation are being established.

Lime will be applied to maintain a pH level between 6.0 to 7.0. The soil pH will be tested every third year to check lime requirements and application rate. Application of lime will be made in the spring or fall only.

The landfill will be mowed once a year in the fall to promote growth and reduce fire hazard from dried material. Grasses may brown during hot, dry periods but will start to green again with the onset of moisture and cooler temperatures. This will be watched but should not be a concern unless erosion is observed.

In capped areas where minor localized differential site settlement causes shallow depressions (total accumulated depth 16 inches or less) in the surface of the vegetated cover where stormwater ponding is occurring, the depressions may be filled with additional topsoil and reseeded to ensure that sufficient slopes are maintained to promote stormwater runoff. The location of the depression, the depth of the depression, the description of repair and the dates of the inspection and repair shall be recorded in accordance with the requirements of Section 6. If this settlement has occurred in an area that has undergone settlement previously, the total accumulated settlement in the area shall also be recorded.

In capped areas where the accumulated localized differential settlement is in excess of 16 inches, maintenance of the components of the cover system will be performed as discussed in Section 2.3.4.

2.3.2 60 Mil HDPE Geomembrane Maintenance

Maintenance of the 60 mil HDPE geomembrane would only be required in conditions of severe localized differential settlement or if the protective barrier layer was penetrated allowing the geomembrane to become punctured. These two scenarios are discussed in the following sections.

2.3.2.1 Settlement-Related Maintenance

The 60 mil HDPE geomembrane installed as part of the cover system has an elongation of 12% at yield and 500% at break, which will enable the geomembrane to withstand the predicted long-term settlement and other localized differential settlement during the 30-year post-closure period as previously discussed in Section 2.2.3. However, it is recommended that maintenance of the geomembrane be performed in areas where the accumulated localized differential settlement has exceeded 16 inches, representing the maximum anticipated secondary settlement over the post-closure period.

In areas where the accumulated localized differential settlement is in excess of 16 inches, maintenance of the components of the cover system will be performed as discussed in Section 2.3.4.

2.3.2.2 Penetration of the Barrier Protection Layer

Penetration of the barrier protection layer is not anticipated to occur in the areas of the site utilizing asphalt or recycled concrete surface treatment, unless maintenance of the barrier protection layer is required. In this case, the procedures identified in Section 2.3.1 will be followed.

Should the barrier protection layer accidentally be penetrated causing puncture of the geomembrane, the barrier protection layer should be removed and the geomembrane should be repaired in accordance with the requirements of the

Capping and Closure Program Contract No. DPW 91-560A Specifications (Contract Specifications).

In the areas of the site using a vegetative cover material, penetration (or damage to) the geomembrane would be limited to the potential for burrowing animals. However, it is expected that any rodents occupying this landfill would be shallow burrowers and their population will be controlled by a vector control program.

As part of the post-closure monitoring and maintenance procedures, the Town will continue the site's existing vector control program to control the population of burrowing animals at the site. Quarterly inspection for burrows will be performed, and an ecologically sound rodent control program will be implemented along the perimeter of the site. When a burrow is found, it will immediately be baited and backfilled. Therefore, the potential for penetration of the barrier protection layer and damage to the geomembrane from burrowers should be eliminated.

2.3.3 Gas Venting Layer Maintenance

It is not anticipated that maintenance of the gas venting layer will be required since it is protected by both the protective barrier layer and the HDPE geomembrane above it. However, should a localized section of the cover system settle by more than 16 inches , maintenance of the components of the cover system will be performed as discussed in Section 2.3.4. The location of the depression, the depth of the depression, the description of repair and the dates of the inspection and repair shall be recorded in accordance with the requirements of Section 6.

2.3.4 Geotextile Filter Fabric Maintenance

It is not anticipated that maintenance of the geotextile filter fabric will be required since it is protected by the protective barrier layer, the HDPE geomembrane and the gas venting layer above it. The filter fabric installed within the cover system is a 100% polypropylene, nonwoven, needle punched fabric with a weight of 7.5 oz/cy and a grab elongation of 50%. The elongation ability will enable the filter fabric to withstand the

predicted long-term settlement and other localized differential settlement during the 30-year post-closure period as previously discussed in Section 2.2.5.

However, should the filter fabric need to be maintained due to unanticipated excessive localized differential site settlement (i.e., greater than 16 inches) or puncture of the HDPE geomembrane as discussed above, the following procedures shall be followed for the affected area: (1) remove the barrier protection layer, the geomembrane, the gas venting layer and the filter fabric; (2) remove any foreign matter which may have been deposited from above; (3) place clean fill as necessary to meet acceptable slopes and grades; (4) replace any material which may have been ripped or damaged with material which meets the material requirements of the Contract Specifications; and (5) repair and/or replace the remaining components of the cover system in accordance with the requirements of the Contract Specifications. A summary of the inspection results, the location of the repair, the description of repair and the dates of the inspection and repair shall be recorded in accordance with the requirements of Section 6.

SECTION 3

DRAINAGE SYSTEM

3.1 Drainage System Description

The stormwater drainage system for the 38-acre former Syosset Landfill consists of toe of slope perimeter drainage ditches which collect the site's stormwater runoff and convey it to storm drains which discharge into three Nassau County recharge basins. Two of the recharge basins (RB 284 and RB 571) are adjacent to the site, while the third basin (RB 358) is located approximately one-quarter mile west of the site. The stormwater drainage system was designed using the 25-year, 24-hour rainfall event in accordance with 6NYCRR Part 360 provisions and is shown on the As Built Plans (see Appendix A).

The perimeter drainage ditches are composed of rip-rap lined and asphalt-lined perimeter collection ditches that intercept runoff along the toe of the landfill slopes. The ditches are trapezoidal in shape with a depth of 1.5 feet and an overall width of 10 feet. The majority of the ditches have a base width of four feet with a side slope of 2:1. The remaining ditches have a base width of 5.5 feet with 1-1/2:1 side slopes. The rip-rap lined ditches utilize 2"-4" stone with an overall depth of 6 inches overlying filter fabric. The asphalt-lined ditches have an asphalt top course depth of 3 inches over an asphalt base course depth of 3 inches.

The drainage ditches convey stormwater to catch basins (Nassau County Type IIIC-modified) connected to reinforced concrete storm drains which discharge through headwalls into the Nassau County Recharge Basins No. 284, 358 and 571.

3.2 Drainage System Maintenance Program

All aspects of the drainage system will require maintenance to ensure that the system as a whole functions properly. In general, this involves the regular inspection of all ditches, pipes, drainage structures and recharge basins for signs of debris build-up,

sediment deposits, and erosion. Inspection of the drainage system will be performed on a quarterly basis and following any major rainfall events (5-year storm events).

Debris and sediment will be removed from the ditches, pipes, drainage structures and existing recharge basins on a regular basis so that normal flow rates are maintained. Debris that is removed will be properly disposed of. Signs of erosion within the recharge basins will be attended to promptly to insure the integrity of the drainage system. These areas will be regraded as necessary or other appropriate measures will be taken to correct the problem and prevent further erosion. Eroded sections of rip-rap lined ditches will be repaired by replacing the eroded rip-rap. Catch basins will be cleaned of debris on a regular basis.

The inspection, maintenance and repair information shall be recorded in accordance with the requirements of Section 6.

SECTION 4

GROUNDWATER MONITORING SYSTEM

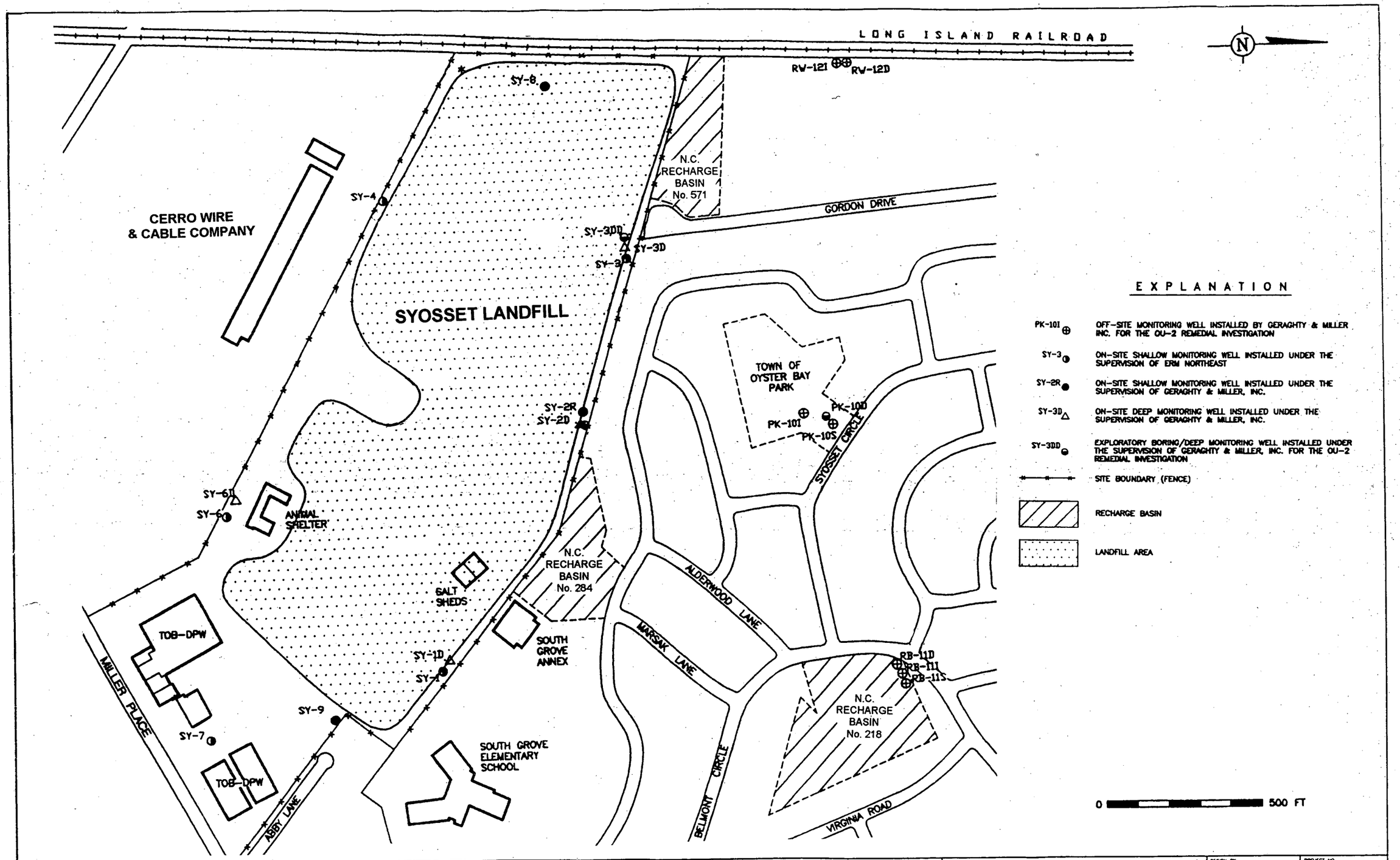
4.1 Groundwater Monitoring System Description

Groundwater monitoring wells have been installed by the Town under three separate contracts comprising an on-site (First Operable Unit - OU1) Remedial Investigation (RI) and an off-site (Second Operable Unit - OU2) RI for the former Syosset Landfill.

There are 13 on-site groundwater monitoring wells and eight off-site groundwater monitoring wells. Their locations are shown on Figure 4-1. The on-site wells are generally located around the perimeter of the landfill, and range in depth from 120 feet to 540 feet below grade. The off-site groundwater monitoring wells are located in three clusters northeast of the landfill. Specifically, in a Nassau County Recharge Basin, a Town Park and the Roadway Express property at 140 Gordon Drive. There are three wells (shallow, intermediate and deep) at the Recharge Basin and Town Park sites and two wells (intermediate and deep) at the Roadway Express Property. The off-site wells range in depth from 140 feet to 500 feet below grade.

4.2 Post-Closure Groundwater Monitoring Well Network

In general, the post-closure groundwater monitoring well network will consist of the on-site wells which showed landfill-related impacts during the previous investigations and the off-site wells whose locations will provide indications of future off-site conditions. The rationale for this approach is based on the age of the landfill, the extensive historic groundwater quality data collected, and the hydrogeologic framework of the aquifer system. Specifically, based on the historic groundwater quality data and the age of the landfill, it can be concluded that the water-quality data generated to date are sufficient to characterize contaminant distribution via the groundwater pathway. It can also be deduced that this pattern will continue to be present throughout the post-closure monitoring period. The hydrogeologic framework indicates that the Magothy Formation is the critical stratigraphic section. The portion of this formation below the water table is known as the Magothy Aquifer (Aquifer). In the absence of distinct water-bearing units,



NO.	DATE	REMARKS	BY

CLIENT
DEPARTMENT OF PUBLIC WORKS
TOWN OF OYSTER BAY
NASSAU COUNTY, N.Y.

SYOSSET LANDFILL
FIRST OPERABLE UNIT REMEDIATION
CAPPING AND CLOSURE PROGRAM

LKB
LOCKWOOD, KESSLER & BARTLETT, INC.
CONSULTING ENGINEERS SINCE 1889 SYOSSET, NEW YORK

DRAWING TITLE
Syosset Landfill
Location of Groundwater
Monitoring Wells

DESIGN BY:	
DRAWN BY:	
CHECKED BY:	
DATE:	
SCALE:	AS NOTED

PROJECT NO. 1024

Figure 4-1

the Aquifer was characterized on the basis of "shallow, intermediate and deep zones" for the purpose of the Remedial Investigations. This convention is maintained in this document.

The groundwater flow direction in all three zones is generally north-northeast, which is consistent with the regional groundwater flow direction. Therefore, Well SY-6, a shallow zone well located on the south perimeter of the landfill across from the Town Animal Shelter, will be used as the upgradient monitoring well for the post-closure period.

The on-site downgradient shallow zone monitoring wells that have shown impacts from the landfill are Wells SY-2R and SY-3. Two of the off-site monitoring wells were installed in the shallow zone of the Aquifer during the OU2 RI. They are Well PK-10S, located at the Town Park property, and Well RB-11S, located in a Nassau County Recharge Basin. The OU2 RI concluded that Well Cluster PK-10 is located directly downgradient of the landfill, but that Well Cluster RB-11 is located outside of the groundwater flow path from the landfill. Therefore, Well PK-10S will be included in the post-closure monitoring well network and Well RB-11S will not.

The on-site downgradient intermediate zone monitoring wells that have been shown to be impacted by the landfill are Wells SY-2D and SY-3D. Three off-site wells were installed in the intermediate zone of the Aquifer during the OU2 RI. They are Wells PK-10I, RB-11I and RW-12I. Well PK-10I will be included in the post-closure monitoring well network due to its location downgradient of the landfill. Well RB-11I will not be included in the monitoring well network because it is located outside the groundwater flow path from the landfill, as previously discussed. Although previous studies concluded that Well Cluster RW-12 is near the periphery of the flow path from the landfill, and that the landfill is not the probable source of the volatile organic compounds (VOCs) detected in Well RW-12I, this well is included in the post-closure monitoring well network so that the Town can identify potential future impacts on downgradient groundwater quality that are not attributable to the landfill.

Four deep zone wells were installed during the OU2 RI. They are Well SY-3DD, which is located on-site at the downgradient landfill boundary, and Wells PK-10D, RB-11D

and RW-12D, which are each located at one of the three off-site well clusters. Although previous samples from Well SY-3DD did not show significant landfill-related impacts, this well is included in the post-closure monitoring well network to monitor the deep zone of the Aquifer at the downgradient landfill boundary. Well PK-10D will be included in the post-closure monitoring well network due to its downgradient location. Well RB-11D will not be included in the post-closure monitoring network since it is outside the groundwater flow path from the landfill. Well RW-12D will be included in the post-closure monitoring well network so that the Town can identify potential future impacts on downgradient groundwater quality in the deep zone of the aquifer that are not attributable to the landfill.

In summary, the monitoring well network will utilize Well SY-6 as the upgradient well. Wells SY-2R, SY-3 and PK-10S will be used to monitor groundwater quality conditions in the shallow zone of the Aquifer. Wells SY-2D, SY3D, PK-10I and RW-12I will be used to monitor groundwater quality conditions in the intermediate zone of the Aquifer. Wells SY-3DD, PK-10D and RW-12D will be used to monitor groundwater quality conditions in the deep zone of the Aquifer. These eleven wells will thus form the post-closure monitoring well network for the landfill, and will provide groundwater quality data representative of both upgradient and downgradient conditions during the post-closure period.

4.3 Post-Closure Groundwater Monitoring Program Elements

The post-closure groundwater monitoring program will be performed by a qualified environmental professional who is familiar with the site, and will consist of synoptic water-level measurements to determine groundwater flow directions, and groundwater sampling to characterize water-quality conditions upgradient and downgradient of the landfill. The water-level data will be collected using an electronic water-level indicator. The groundwater samples will be collected using the USEPA Region II Low Flow Purging and Sampling Procedure (included in Appendix B) as modified herein. Specifically, given that depth to the water table is more than 100 feet, that the depths of some wells exceed 500 feet, and that the monitoring will be performed annually, the most technically feasible way to employ the low-flow method is to use non-dedicated pumps placed just below the static water level, rather than within the wells' screen

zones. Moreover, since the existing dedicated pumps are single-speed models with flow rates of approximately 7 gallons per minute, they can not be used for the low-flow method and will be removed.

A detailed description of each element of the groundwater monitoring program is provided below. Note that, in the event that the purging and sampling equipment specified below is not available throughout the entire post-closure period, technological improvements warrant using different equipment, or the data collected support a change in the scope of the monitoring program, the Town may petition the USEPA to modify the pertinent aspect of the program as the Town deems appropriate.

4.3.1 Field Record Keeping

A detailed record of field activities will be kept in bound field notebooks. The pertinent sampling-related information will be recorded, including the date, time, personnel present and weather conditions during sampling, as well as instrument calibrations and measurements, and field observations.

4.3.2 Water-Level Measurement

Water-level measurements will be made using a calibrated electronic water-level indicator, such as a Slope Indicator Company Water Level Indicator, or equivalent. Measurements will be made to the nearest 0.01 feet relative to the permanent, surveyed measuring point on each well. The water-level indicator's sensor, and any cable that comes into contact with the water in a particular well, will be rinsed with distilled water and dried with a paper towel prior to use in the next well.

Following the measurement of water levels in the wells, the first well will be measured again to determine the magnitude of any temporal change. If a significant change is detected (0.05 feet or more), an equivalent correction factor will be applied to the data as a linear function.

The water-level data will be subtracted from the measuring point elevations to calculate the water-level elevation in each well. The results from each round will be reviewed in the field and any anomalous results will be re-measured. The water-level data, and well construction records (i.e., diameter and depth), will be used to calculate the volume of

standing water (i.e., the casing volume) in each well in the monitoring network prior to the start of sampling.

At the time that the water-level data are collected, each well will also be inspected to verify its ability to be sampled and identify any required maintenance. The results from each well inspection will be recorded on a Well Inspection Checklist form (see Section 6).

4.3.3 Sampling Equipment and Well Purging Procedures

Since monitoring is to be performed annually, non-dedicated purging and sampling equipment will be used. The wells will be purged using a Grundfos Redi-Flo2 Variable Performance submersible pump (or equivalent) equipped with approximately 200 feet of electrical cable and Teflon-lined polyethylene tubing on a reel. The pump apparatus will be stored and transported in a clean Rubbermaid-style bin equipped with a tight-fitting lid. An Invertron BMI/MP1 frequency inverter (or equivalent) will be used to control the flow rate of the pump. A gasoline-powered generator will be used to provide electrical power for the pump and control box.

Prior to use in each well, the pump apparatus will be decontaminated by filling the bin with a mild Alconox detergent/potable water solution, washing the outside of the pump apparatus and turning on the pump long enough to flush the pump and tubing. The detergent/water solution will then be drained and the outside of pump apparatus will be rinsed with potable water. The bin will then be filled with potable water and the pump will be turned on long enough to flush the pump and tubing again. The rinse water will then be drained from the bin and the pump will be raised above the tubing to drain the rinse water from the tubing as well. The pump apparatus and bin interior will then be rinsed with distilled water. The distilled water rinsate will then be drained and the lid placed on the bin.

Sampling will begin at the upgradient well and then proceed with the downgradient wells. Upon arriving at a particular well, the well will be unlocked and opened, and clean plastic sheeting will be placed on the ground around the well to keep the sampling equipment from contacting the ground. Field personnel will wear new disposable latex

gloves when handling sampling equipment. The pump apparatus will be placed in the well approximately five feet below the static water level, and the water-level indicator probe will be placed in the well to monitor drawdown during purging.

Each well will be purged at a sufficiently low flow rate to maintain a drawdown of less than 0.3 feet. The purge water will be collected and taken to the Town's leachate treatment facility at the Old Bethpage Solid Waste Disposal Complex for disposal. One casing volume will first be purged from each well to remove the standing water so that a representative groundwater sample can be collected. The well will then continue to be purged until the indicator parameters specified in Section V.12 of Appendix B have stabilized. The indicator parameters will be monitored using a Horiba U-22 Water Quality Checker, or equivalent. The instrument will be calibrated according to its instruction manual prior to use and the instrument's probe will be inserted in a flow-though cell prior to taking measurements.

4.3.4 Measuring Part 360 Field Parameters

Immediately following purging of each well, the field parameters pH, specific conductivity, ORP, dissolved oxygen (DO) and turbidity will be measured by reading their value directly from the instrument's display as per the instruction manual. The Horiba U-22 will be set to display readings to two decimal places for greater sensitivity. Since the low flow method is to be used, it is not necessary to collect the VOC samples prior to measuring the field parameters.

4.3.5 Collecting Groundwater Samples for Laboratory Analysis

Immediately prior to collecting each sample (e.g., during purging) the appropriate bottles will be labeled with the sample number (i.e., the well number), date and time collected, site location and job number, as well as any other pertinent information indicated on the sample labels. The sample bottles containing preservatives usually arrive from the laboratory with the necessary warning labels already on them, so it will probably not be necessary to include this information on the sample labels. The analyses to be performed will be indicated on the chain of custody and therefore do not

need to be included on the sample labels. Extra sample bottles will be ordered from the laboratory to account for any breakage during shipment.

Each groundwater sample for laboratory analysis will be collected directly from the pump discharge into pre-cleaned and preserved laboratory-supplied bottles starting with the VOC samples, and proceeding in the order of the parameters' volatilization sensitivity. Samples for metals analyses will consist of unfiltered and filtered samples. A list of standard sample bottle requirements, preservatives and holding times for various laboratory analyses is provided in Table 4-1. This table may be modified based on the specific protocols used by the laboratory selected to perform the analyses.

4.3.6 Collecting Blanks and Duplicate Samples

A daily trip blank, one equipment blank and one anonymous duplicate sample will be collected during each monitoring round and submitted for laboratory analysis. The trip blank will be supplied by the laboratory in sealed 40-milliliter glass vials and will accompany the sample bottles and samples at all times during the monitoring round. The trip blank will be analyzed for VOCs only. The equipment blank will be collected by pouring laboratory-supplied de-ionized water over the decontaminated pump apparatus and into a set of sample bottles. The duplicate sample will be collected by simultaneously filling a second set of sample bottles from a selected well and giving it a different sample number. The equipment blank and duplicate sample will be analyzed for all laboratory parameters. Note that, due to the limited scope of the sampling program, matrix spike/matrix spike duplicate (MS/MSD) samples, which are an additional laboratory QA/QC sample, will not be collected. Instead, the samples will be "batched" with other samples at the laboratory for which an MS/MSD is being performed. The MS/MSD results will be included in the annual monitoring reports.

4.3.7 Packaging and Shipping of Samples and Blanks

As soon as they are collected, the samples and blanks will be placed in coolers with sufficient ice or ice packs to keep them chilled to 4°C. Prior to shipping, each sample bottle will be wrapped in bubble wrap, and enough additional ice or ice packs will be

TABLE 4-1

Summary of Sample Bottle, Preservative and Holding Time Requirements

Laboratory Parameter	Sample Bottle Requirements	Chemical Preservative	Holding Time
Part 360 Leachate Indicators			
Alkalinity[1]	250-ml plastic	None	14 days
Ammonia[2]	250-ml plastic, rinsed with HCl	H_2SO_4 to pH<2	28 days
Biological Oxygen Demand (BOD)	1-L plastic or glass	None	48 hours
Chemical Oxygen Demand (COD)	250-ml glass	H_2SO_4 to pH<2	28 days
Chloride[1]	250-ml plastic	None	28 days
Color[1]	250-ml plastic	None	48 hours
Hardness (Total)	250-ml plastic, rinsed with HNO_3	HNO_3 to pH<2	180 days
Nitrate (as Nitrogen)	250-ml plastic, rinsed with HCl	None	48 hours
Phenols (by GC/MS)	1-L glass with Teflon-lined cap	None	7 days (extraction) 40 days (analysis)
Sulfate[1]	250-plastic	None	28 days
Total Dissolved Solids (TDS)	250-plastic, rinsed with HNO_3	None	7 days
Total Kjeldahl Nitrogen (TKN)[2]	250-plastic	H_2SO_4 to pH<2	28 days
Total Organic Carbon (TOC)	250-ml amber glass with Teflon-lined cap, no headspace	H_2SO_4 to pH<2	28 days
Inorganic Parameters			
All parameters except cyanide	1-L plastic, rinsed with HNO_3	HNO_3 to pH<2	180 days* (* mercury 28 days)
Cyanide (Total)	1-L glass	NaOH to pH>12	14 days
Organic Parameters			
Volatile Organic Compounds	2 40-ml glass vials with Teflon-lined septa caps, no headspace	HCL to pH<2	14 days
Pesticides/Herbicides[3]	1-L glass with Teflon-lined cap	None	7 days extraction 40 days analysis
Polychlorinated Biphenyls (PCBs)[3]	1-L glass with Teflon-lined cap	None	7 days extraction 40 days analysis

Footnotes: 1 - alkalinity, chloride, color and sulfate can be combined in one sample bottle.
2 - ammonia and TKN can be combined in one sample bottle.
3 - pesticides, herbicides and PCBs can be combined in one sample bottle.
ml = milliliters
L = liter
H2SO4 = sulfuric acid
HNO3 = nitric acid
NaOH = sodium hydroxide
HCl = hydrochloric acid

added to keep the samples chilled to 4°C during shipment. Chain of custody forms will be completed, placed in Zip-Loc bags and taped to the inside lids of the coolers.

The coolers containing the samples and blanks will be tightly sealed with heavy-duty duct tape, and custody seals will be placed on the coolers so that they must be broken to open the coolers. The coolers will be shipped to the laboratory via overnight courier (e.g., Federal Express) for next morning delivery. Whenever possible, samples will be shipped by Thursday so that they arrive at the laboratory by Friday morning, to avoid potential weekend delivery problems. The laboratory will be contacted the next day to ensure that the samples arrived.

4.3.8 Post-Closure Monitoring Parameters

The post-closure groundwater monitoring parameters are listed in Table 4-2. This list is identical to the revised parameter list in Table 2-6 of the OU2 RI, which was developed based on a re-evaluation of the OU1 RI water-quality data in conjunction with the then current OU2 RI field data, and is considered appropriate for post-closure monitoring. This list is comprised of selected volatile organic compounds (VOCs), metals and leachate parameters. Note that some of the VOCs listed in Table 4-2 are designated with an "(a)". These are additional parameters that were not on the revised parameter list but are included in the analytical method and were detected during the OU2 RI. These additional VOCs are not contaminants of concern for this project. However, should any be detected, the results will be reported and qualified with an "(a)", as previously done during the OU2 RI. For metals analyses, both filtered and unfiltered samples will be collected. The filtered samples will be collected using dedicated, disposable in-line filters. The filtered metals data will allow direct comparison to previous samples, which were also filtered.

4.3.9 Laboratory Methods and Detection Limits

Consistent with the OU1 and OU2 RI's, laboratory analyses will be performed in accordance with the USEPA Contract Laboratory Program (CLP) Statements of Work (SOWs) for Low Concentration Organic Analytical Service for Superfund (Water Matrix) (OLC03.2) and Multi-Media, Multi-Concentration Inorganic Analysis (ILM05.2). It should

TABLE 4-2

SYOSSET LANDFILL POST-CLOSURE GROUNDWATER MONITORING PROGRAM
PARAMETER LIST

Volatile Organic Compounds	**Metals**
Dichlorodifluoromethane	Antimony
Chloromethane	Arsenic
Vinyl chloride	Barium
Bromomethane	Beryllium
Chloroethane	Cadmium
Trichlorofluoromethane	Chromium
1, 1-Dichloroethene	Copper
Acetone (a)	Iron
Carbon Disulfide (a)	Lead
Methylene chloride	Mercury
trans-1, 2-Dichloroethene	Nickel
1,1-Dichloroethane	Potassium
2-Butanone (a)	Selenium
cis-1, 2-Dichloroethene (a)	Silver
Chloroform (a)	Sodium
1, 1, 1-Trichloroethane	Thallium
Carbon tetrachloride	Zinc
Benzene	
1, 2-Dichloroethane	**6NYCRR Part 360**
Trichloroethene	**Leachate Indicator Parameters**
1, 2-Dichloropropane	
Bromodichloromethane	Specific conductance (field)
2-Chloroethyl vinyl ether	PH (field)
cis-1, 3-Dichloropropene	Alkalinity
4-Methyl-2-Pentanone (a)	Ammonia
Toluene	Biological Oxygen Demand
Trans-1, 3-Dichloropropene	Bromide
1, 1, 2-Trichloroethane	Chemical Oxygen Demand
Tetrachloroethene	Chloride
2-Hexanone (a)	Color
Dibromochloromethane	Hardness (Total)
Chlorobenzne	Nitrate (as Nitrogen)
Ethylbenzene	Phenols
m&p-Xylene (a)	Sulfate
o-Xylene (a)	Total Dissolved Solids
Styrene (a)	Total Kjeldahl Nitrogen
Bromoform	Total Organic Carbon
1,1,2,2-Tetrachloroethane	

(a) This compound was not included on the revised parameter list but was also analyzed. In May and June 1993, samples were collected by Geraghty & Miller, Inc. from Well Pk-10I for analysis of volatile organic compounds (VOCs). The laboratory analyzed these samples for the VOCs on the original parameter list included in the OU-2 RI Work Plan. However, because the laboratory (IEA Laboratories, Inc.) calibrates its analytical instruments for VOCs using commercial standards that contain a comprehensive list of VOCs that include more compounds than are contained in the parameter list, some of these additional VOCs were detected in this sample. This is the reason why these additional compounds were reported and included in this Table.

be noted that these methods include the full USEPA Target Compound List (TCL) Organic parameters and Target Analyte List (TAL) Inorganic parameters. As previously discussed under Section 4.3.8, these lists contain more parameters than those included in the Post-Closure Monitoring Program Parameter List. Parameters detected by these methods which are not on the Post-Closure Monitoring Program List will be marked with an (a) on summary tables. Leachate parameters will be analyzed in accordance with the NYSDEC suggested methods delineated under 6NYCRR Part 360-2.11(d)(6), which is contained in Appendix C.

Laboratory analyses will be performed by a laboratory selected as discussed under Section 4.3.10 below. The standard operating procedures (SOPs) of the selected laboratory will be obtained and kept on file for the period in which the laboratory is utilized. Data reporting requirements will be consistent with USEPA Region II Quality Assurance/Quality Control requirements.

The applicable water quality standards and guidance values for each of the full list of analytical parameters are listed in Appendix D. The most stringent standard or guidance value for each monitoring parameter will be the data quality objective for that parameter. For nearly all parameters, the most stringent value is the NYSDEC Water Quality Standard or Guidance Value for Class GA groundwater. It is expected that this will continue to be the case for the foreseeable future. As such, the NYSDOH MCLs and Standards for Raw Water Quality, and the USEPA MCLs and Secondary MCLs will most likely only apply to parameters for which a NYSDEC Water Quality Standard or Guidance Value does not exist.

These standards and guidance values are updated regularly; therefore, a key data quality objective is to ensure that the most current limits are used to assess groundwater quality. This objective will be met by periodically contacting the appropriate regulatory agencies to obtain the latest version of these standards and guidance values, and incorporating any changes into the monitoring program. It is recognized that the standard or guidance value for a particular parameter may become either more restrictive or less restrictive over time; and the most current limit, whether it is higher or lower, will be used.

To the extent possible, the minimum detection limit for each parameter will be at least as low as the current standard or guidance value for that parameter. For the key parameters of concern, such as VOCs and heavy metals, this is readily achievable through low-level analysis. However, it is recognized that for some parameters with very low standards, such as certain pesticide-related compounds, it may not be possible to achieve minimum detection limits that are as low as their standards. In these cases, the laboratory will be required to provide their lowest possible method detection limits, which will be used to evaluate groundwater quality with respect to these parameters.

Minimum Quantitation Limits for the post-closure groundwater analytical parameters are listed in Appendices C, E and F. These limits are based on (1) the 6NYCRR Part 360 Leachate Indicator Parameter Practical Quantitation Limits; (2) the USEPA Statement of Work for the Low Concentration Organic Analysis (OLC03.2) Contract Required Quantitation Limits; and (3) the USEPA Statement of Work for the Multi-Media, Multi-Concentration Inorganic Analysis (ILM05.2) Contract Required Quantitation Limits, respectively. Note that these limits may be modified in the future, as appropriate, to reflect any changes in the various standards or guidance values, or laboratory testing methodology.

4.3.10 Laboratory Selection

In calendar year 2000, the New York State Department of Health (NYSDOH) became the authorizing agency to certify environmental laboratories in New York State under the National Environmental Laboratory Accreditation Program (NELAP). The agency responsible for this is the Wadsworth Center, and their program is known as the Environmental Laboratory Approval Program (ELAP). It is mandated by Section 502 of the Public Health Law. Section 502.2 of this law states that an environmental laboratory performing analyses of samples collected in New York State must be certified in the applicable categories and analytes.

At a minimum, the selected laboratory will be certified under the NYSDOH ELAP. In addition, when possible, attempts will be made to solicit laboratories that are also currently in the USEPA CLP. However, it should be noted that only a limited amount of USEPA CLP laboratories are certified under the NYSDOH ELAP at this time. Should a

non-USEPA CLP laboratory be chosen they would have to analyze performance evaluation samples provided by the USEPA.

4.4 Post-Closure Groundwater Monitoring Schedule

Based on the age of the landfill (over 60 years), the time elapsed since the landfill closed (over 23 years) and the extensive water-quality database developed since closure, post-closure groundwater monitoring will be performed on an annual schedule.

The results of groundwater monitoring conducted during both the OU1 RI and OU2 RI indicated low levels of VOCs, semi-volatile organic compounds and metals. In general, although there may be slight variations in concentrations between sampling events, there have not been any significant variations that would substantiate the need for monitoring groundwater quality on a more frequent basis than annually. Furthermore, with the completion of the site-wide cap, further infiltration of stormwater through the landfill will be significantly reduced and future groundwater quality in the vicinity of the landfill should improve. In light of these considerations, it is appropriate to perform post-closure groundwater monitoring on an annual frequency. The results of the annual groundwater monitoring will be summarized in an Annual Summary Report.

4.5 Groundwater Monitoring Well Maintenance

On-site and off-site groundwater monitoring wells shall be inspected prior to each monitoring round to ensure that they are in operable condition. Any damage found shall be repaired so that monitoring will be performed on schedule. Items to be inspected will include the wellhead castings, protective steel casings, exposed well casings and fittings. Any damaged parts will be repaired or replaced. The Town will maintain access to each on-site groundwater monitoring well including removing weed and brush growth from around the wells. The inspection, maintenance and repair information shall be recorded in accordance with the requirements of Section 6.0.

SECTION 5

LANDFILL GAS VENTING SYSTEM

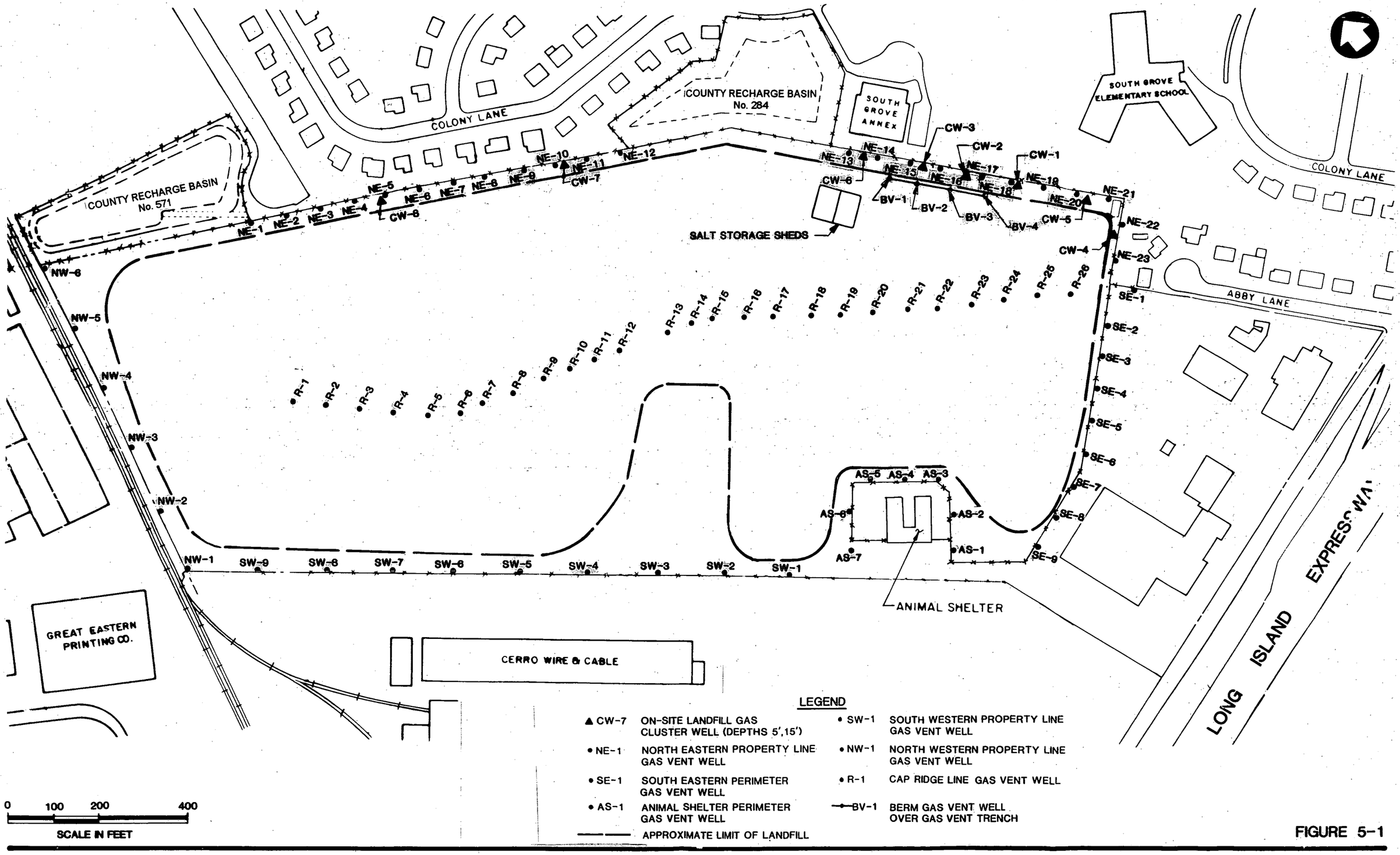
5.1 Landfill Gas Venting System Description

The existing landfill gas venting system consists of 38 property line gas vent wells, 16 perimeter gas vent wells and 26 landfill ridge gas vent wells as shown on Figure 5-1. Eight gas monitoring cluster wells and a gas venting trench located along the property line adjacent to the South Grove Elementary School were installed during previous work performed at the site. In addition, during the Capping and Closure Program, four six inch diameter PVC gas vent wells were placed over a gas venting trench (installed during the Preload Program) located within the landfill limits in an area northeast of the Salt Storage Sheds. The vent wells were installed to allow the trench to continue venting, if necessary, following the placement of the cap and an earthen berm over the trench.

The perimeter gas vent wells are six inch diameter PVC wells extending 52 feet below grade with a screen length of 40 feet. The landfill ridge gas vent wells are six inch diameter PVC wells, extending 32 feet below the landfill cap surface with a screen length of 30 feet. The gas monitoring cluster wells contain three wells per cluster. Each well is two inches in diameter with depths ranging from 5 to 35 feet deep. The gas venting trench is a gravel filled trench, 500 feet long, four feet wide and ten feet deep with a liner located vertically along the trench wall on the school side of the trench.

5.2 Regulatory Requirements

According to the USEPA's ROD for the site, following the installation of the final cap and venting system, two rounds of gas vent sampling for methane and non-methane VOCs should be conducted to determine whether conversion to an active system and/or treatment of gas emissions would be necessary. Two rounds of gas monitoring and sampling were performed on May 12, 1999 and October 19, 2001. Based on the results of these sampling events, the USEPA determined that conversion to an active gas collection system or treatment of gas emissions was not required.



0 100 200 400

SCALE IN FEET

LEGEND

▲ CW-7	ON-SITE LANDFILL GAS CLUSTER WELL (DEPTHS 5',15')	• SW-1	SOUTH WESTERN PROPERTY LINE GAS VENT WELL
• NE-1	NORTH EASTERN PROPERTY LINE GAS VENT WELL	• NW-1	NORTH WESTERN PROPERTY LINE GAS VENT WELL
• SE-1	SOUTH EASTERN PERIMETER GAS VENT WELL	• R-1	CAP RIDGE LINE GAS VENT WELL
• AS-1	ANIMAL SHELTER PERIMETER GAS VENT WELL	—•— BV-1	BERM GAS VENT WELL OVER GAS VENT TRENCH
———	APPROXIMATE LIMIT OF LANDFILL		

FIGURE 5-1

LKB

LOCATIONS OF LANDFILL GAS VENT WELLS
SYOSSET LANDFILL
SYOSSET, N.Y.

The ROD further stipulates that (1) long-term monitoring should comply with the 6NYCRR Part 360 landfill closure regulations, and (2) New York State Pollution Control Regulations, 6NYCRR Parts 219, 202 and 201 regarding air emissions must be complied with as well.

The provisions of 6NYCRR Part 360-2.15(k)(4) state that post-closure monitoring of explosive gases must be performed at least quarterly to determine if the facility complies with the provisions of 360-2.17(f), which provide that the concentration of methane generated at the facility must not exceed: (1) twenty-five percent of the lower explosive limit (i.e., 1.25% gas in air) for gases in structures on- or off-site, excluding gas control or recovery systems; and (2) the lower explosive limit (i.e., 5% gas in air) for gases at or beyond the property boundary. These parameters have been complied with thus far at the site and a provision for continued gas monitoring has been included in this program to fulfill this requirement.

A review of the New York State Pollution Control Regulations shows that 6NYCRR Part 219 and Part 202 pertain to incinerators and emission testing of stacks, respectively. These regulations are not applicable to the former Syosset Landfill since incinerators and stacks are not present at the site. Part 201 pertains to obtaining State and local permits or registration certificates for the operation of air contamination sources and complies with the federal Clean Air Act Amendments of 1990 regarding permitting of Title V sources. However, Part 201 specifically identifies landfill gas systems which vent directly to the atmosphere, and are part of a valid Part 360 permit or Consent Order, as being an activity that is exempt from State and Title V permitting requirements. Furthermore, in accordance with the Clean Air Act, the USEPA has adopted regulations (40 CFR 60 Subparts WWW and Cc) governing New Source Performance Standards and Emissions Guidelines for new and existing Municipal Solid Waste (MSW) landfills. The former Syosset Landfill was closed in 1975 and, therefore, the new regulations do not apply since they govern landfills which accepted waste after November 8, 1987 (the date established in the regulations). Therefore, 6NYCRR Parts 219, 202 and 201 do not pertain to activities at this site.

monitoring for Methane will be conducted at the property line. The bar-hole monitoring will be performed along the adjacent site fenceline, perpendicular to the vent in question. If gas concentrations of 5% or greater are encountered, multiple bar-holes will be employed in order to define the lateral extent of gas detected.

If monitoring indicates combustible gas levels greater than 25 percent of the lower explosive limit (LEL) in structures or greater than the LEL at the property boundary (as indicated by a barhole survey), the following actions will be taken:

- the USEPA and NYSDEC will be notified immediately and all steps necessary to ensure safety and human health protection will be taken;

- within 7 days of detection, the methane gas levels encountered and a description of the steps taken to protect human health will be submitted to USEPA and NYSDEC; and

- within 45 days of detection, a plan and schedule to implement a remediation program for the methane gas releases will be submitted to the USEPA and NYSDEC. The implementation of this plan will be performed within 60 days of the date of detection.

5.4.2 Protocol for Long-Term Gas Monitoring in the Vicinity of the South Grove School Property Line

5.4.2.1 Existing Passive Gas Venting System in the Vicinity of the South Grove School Property Line

In 1981, the Town installed a passive gas venting system outside the footprint of the landfill in the vicinity of the South Grove School property line as an interim measure to prevent the potential for off-site gas migration in this area. The system consisted of a gravel filled gas venting trench (500 feet long, by four feet wide, by ten feet deep) and a series of PVC gas vent riser pipes on both the landfill side and school side of the gas venting trench. The trench contained an impermeable membrane lining the school side of the trench that enabled gas

that was collected in the trench to be vented to the atmosphere. The depth of the gas vent riser pipes ranged from 2.4 feet to 9.2 feet below grade. The riser pipes on the school side of the trench were monitored to ensure that levels of gas were below the 6NYCRR Part 360 property line limits. The efficiency of the trench was verified by monitoring and comparing the levels of gas within the riser pipes on the landfill and school sides of the trench. Typically gas levels on the school side of the trench would be very low, while gas levels on the landfill side of the trench would be somewhat higher, indicating that the trench was working properly.

The Town historically monitored the combustible gas levels at the existing gas venting trench system in the vicinity of the South Grove School property several times a week. Monitoring for methane was performed using a Combustible Gas Indicator. The data was submitted to the NYSDEC, New York State Department of Health (NYSDOH), the Nassau County Department of Health (NCDOH) and the Syosset Central School District (SCSD) on a monthly basis.

Since the trench was installed in 1981, the number of gas vent riser pipes that have been monitored decreased substantially over time due to the lack of gas detected towards either end of the trench. In December 1989, three additional gas monitoring cluster wells were installed along the landfill property line adjacent to the South Grove School. Each cluster well contained three, two inch diameter wells whose depths were five feet, ten feet and 35 feet below grade. Since their installation, these wells were monitored as part of the gas venting trench system. In 1995, the Town installed eight, six inch diameter, 52 foot deep gas vent wells along the property line in the vicinity of the South Grove School as part of the site's perimeter passive gas control system constructed under the Preload Program. These wells were also monitored as part of the gas venting trench system after their completion.

5.4.2.2 Gas Monitoring Data in the Vicinity of the South Grove School Property Line Following the Commencement of the Capping and Closure Program

A review of the gas monitoring data from August 1996 to May 1998 was performed to identify the gas migration trends in this part of the site following the commencement of the Capping and Closure Program in August 1996. The data shows that the gas levels at the property line continued to be lower than the 6NYCRR Part 360 provisions (i.e., 5% gas in air) which is consistent with historic gas data at this property line location. In fact, there were only four days in this 22 month time frame during which low levels (0.2% to 3.5%) of gas were detected in four of the 28 wells located along the property line side of the trench. The remaining days that were monitored showed no methane in any of the wells located along the property line. In fact, there was no detection of gas in any of the gas vent wells on the property line side of the gas venting trench during the last 18 months of monitoring from November 12, 1996 through data reported in May 1998. In addition, during the period from January 3, 1997 through July 2, 1997, no gas was detected on the landfill side of the trench either. In July 1997, the cap was constructed on the landfill side of the trench and the gas vent riser pipes on the landfill side of the trench were abandoned and were not monitored thereafter.

As reported above, the gas vent wells on the property line side of the gas venting trench continued to be monitored after cap construction in this area and detected no gas through May 1998. The gas monitoring data collected on the property line side of the gas venting trench over the ten month period since the time the cap was placed in that area in July 1997 indicates that the cap and gas venting layer system placed over the landfill were operating as designed to prevent off-site gas migration.

5.4.2.3 Post-Closure Gas Monitoring Well Network in the Vicinity of the South Grove School

In order to monitor gas in the vicinity of the South Grove School property line during the post-closure period, the existing wells in the area were reviewed in conjunction with the provisions of 6NYCRR Part 360 to determine which wells would be appropriate for inclusion in the post-closure gas monitoring well network.

The gas vent wells which currently continue to be monitored by the Town in the vicinity of the gas venting trench are the eight property line gas vent wells (NE-13 through NE-20), three gas monitoring cluster wells (CW-1 through CW-3) and 17 gas vent riser pipes on the school side of the trench (1S through 17S). The layout of these three different gas vent well groups is such that wells NE-13 through NE-20 are located along the site fence line running the full length of the property line between the landfill and the school property (see Figure 5-1); gas cluster wells CW-1 through CW-3 are intermingled among the NE wells along the property line (see Figure 5-1); and the gas vent riser pipes 1S through 17S are further into the landfill property between the gas venting trench and the property line. The alignment of these gas vent riser pipes is parallel the NE gas vent wells, but does not extend the full length of the property line at that location.

The provisions of 6NYCRR Part 360 state that post-closure monitoring of explosive gases at the property line must be performed to determine that the concentration of methane gas generated at the facility does not exceed the lower explosive limit (i.e., 5% gas in air) for gases at or beyond the property boundary.

The continued monitoring of gas vent riser pipes (1S through 17S) during the post-closure period will no longer supply useful information since: (1) these wells are not the closest wells to the property line, so they can not be used to meet the property line provisions of 6NYCRR Part 360; (2) gas vent wells NE-13 through NE-20 provide gas monitoring data at the property line over the full depth of the landfill and will comply with 6NYCRR Part 360 provisions; (3) wells 1S through 17S are shallow wells (i.e., 2.4 to 9.2 feet below grade) and will not provide data

over the full depth of the landfill in this area; (4) the data from wells 1S through 17S can no longer be compared to the gas vent riser pipes on the landfill side of the trench to determine trench operation efficiency; (5) the need for the continued use of the gas venting trench is no longer necessary since the site-wide cap/gas venting layer system is complete and preventing off-site gas migration based on ten months of monitoring data obtained since cap installation; and (6) the gas data collected over the 22 month period following the commencement of the cap construction in these wells does not indicate an accumulation of gas at this location.

The gas cluster wells (CW-1 through CW-3) are located along the property line, but only extend from five feet to 35 feet below grade and are not located along the full length of the property line. Although these wells would provide information over this depth, gas vent wells NE-13 through NE-20 will provide gas level information over the full 52 foot depth of the landfill for the entire length of the property line at the South Grove School. Since monitoring data from the cluster wells would provide somewhat of a redundancy of data but over a shallower depth and limited horizontal extent, monitoring these wells will not be performed as part of the long-term post-closure monitoring program. However, should gas monitoring data indicate the existence of gas at the property line, the cluster wells could be used to determine gas levels at various depths along the property line at their locations.

Therefore, since gas monitoring data has shown that potential off-site gas migration is successfully being controlled by the site-wide cap/gas venting layer system and the property line gas vent wells will meet the provisions of 6NYCRR Part 360, the long-term post-closure gas monitoring well network in the vicinity of the South Grove School property line will consist of property line gas vent wells NE-13 through NE-20.

5.4.2.4 Post-Closure Gas Monitoring Schedule in the Vicinity of the South Grove School

The lack of the existence of gas in the vicinity of the South Grove School property line over the 22 month period following cap construction commencement and the gas monitoring data obtained since the completion of the site-wide cap and passive gas venting/control system indicates that the cap/gas venting system is preventing off-site gas migration.

Monitoring at property line gas vent wells NE-13 through NE-20 will be performed quarterly as required by 6NYCRR Part 360-2.15 post-closure provisions. Gas monitoring will be performed under falling barometric conditions (if possible) which have been identified to be the worst case conditions for gas migration. The results of the gas monitoring program at wells NE-13 through NE-20 will continue to be submitted to the SCSD, NYSDEC, NYSDOH and the NCDOH for review on a quarterly basis.

The quarterly monitoring of the gas vent wells located along the School property line (NE-13 through NE-20) will ensure that gas levels at the property line are complying with the 6NYCRR Part 360 provisions. Should future gas monitoring data indicate levels in excess of the 6NYCRR Part 360 provisions, the affected property line gas vent wells can be converted to active wells to prevent off-site gas migration.

5.5 Gas Venting System Maintenance

Minimal maintenance of the passive gas venting system is required. Routine inspections should be performed prior to quarterly monitoring to ensure that the wells are not damaged and that access is maintained to the wells. If wells are damaged, they should be repaired or replaced in accordance with the requirements of the Capping and Closure Program Contract Specifications. The inspection, maintenance and repair information shall be recorded in accordance with the requirements of Section 6.

Now that the site-wide cap and gas venting system is in place and operational, with gas monitoring data indicating the continued prevention of off-site gas migration in the vicinity of the South Grove School property, the future monitoring and maintenance of the existing passive gas venting trench is no longer necessary.

SECTION 6

REPORTING REQUIREMENTS

The Town of Oyster Bay will submit an Annual Summary Report to the USEPA and NYSDEC in conformance with the provisions of 6NYCRR Part 360-2.15(k)(4). The Annual Summary Report will describe the maintenance, monitoring and/or sampling results obtained during the previous year for the former Syosset Landfill Capping and Closure system.

The discussion of each of the components of the post-closure monitoring and maintenance program for the capping and closure system will include information identified in the following sections. A summary of the inspection, monitoring and maintenance schedule is shown on Table 6-1 for reference.

6.1 Cover System

Inspection of the cover system will be performed quarterly and following major rainfall events (5-year storms). A summary of the results of the inspections will be provided in the Annual Summary Report. Specific information will include the following:

- note areas showing asphalt pavement cracks, surface material erosion, insufficient vegetative cover growth, erosion of vegetative cover and areas of surface settlement along with the inspection date and inspection personnel on the Cover System Inspection Report form shown on Figure 6-1;
- locate these areas on a 1 inch = 100 foot scale site plan; and
- indicate repair date, methods employed and personnel involved on the Cover System Repair Report Form shown on Figure 6-2.

6.2 Drainage System

Inspection of the drainage system will be performed quarterly and following major rainfall events (5-year storms). The inspectors will note the approximate quantities and locations of debris or sediment removed from the drainage structures; i.e., ditches,

TABLE 6-1

SYOSSET LANDFILL
INSPECTION, MONITORING AND MAINTENANCE SCHEDULE

TASK	FREQUENCY				REMARKS
	ANNUALLY	QUARTERLY	AFTER MAJOR RAINFALL EVENTS	OTHER	
COVER SYSTEM					
- Cap Surface Inspection/Repair					
- Surface Cracks/Depressions		X	X		
- Vegetation Growth		X	X		
- Surface Erosion		X	X		
- Settlement		X	X		
- Burrowing Animals		X	X		
- Topsoil pH Testing				Every 3 yrs.	
- Vegetation/Grass Mowing	X				
- Site Survey During the Initial Post-Closure Period (1st 3 yrs.)	X				
DRAINAGE SYSTEM					
- Inspect/Maintain Drainage System					
- Inspect System & Repair Damage		X	X		
- Remove Debris/Sediment		X	X		
- Repair Recharge Basin Erosion		X	X		
GROUNDWATER MONITORING SYSTEM					
- Inspect/Repair Monitoring Wells	X				
- Sample Monitoring Wells	X				
GAS MONITORING SYSTEM					
- Perimeter Gas Vent Inspect./Monitoring		X			

FIGURE 6-1

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAM

COVER SYSTEM INSPECTION REPORT

Inspection Date: _____

Inspection Frequency:

- ☐ Quarterly
- ☐ Following 5-year Rainfall Event

Inspection Personnel:

_____

_____

_____

_____

ITEM	DEFECT INFORMATION[1]		
	ID No.	DESCRIPTION	OBSERVED CAUSE
CAUSE			
1. Surface Cracks (Asphalt)	None		
	AC1	_____	_____
	AC2	_____	_____
	AC3	_____	_____
2. Surface Cracks (Recycled Concrete)	None		
	RC1	_____	_____
	RC2	_____	_____
	RC3	_____	_____
3. Surface Cracks (Vegetative Cover)	None		
	VC1	_____	_____
	VC2	_____	_____
	VC3	_____	_____
4. Surface Material Erosion	None		
	SE1	_____	_____
	SE2	_____	_____
	SE3	_____	_____
5. Vegetation Growth	None		
	VG1	_____	_____
	VG2	_____	_____
	VG3	_____	_____
6. Settlement (Indicate current depth and cumulative depth)	None		
	S1	_____	_____
	S2	_____	_____
	S3	_____	_____
7. Ponding Areas (after rainfall events, identify depth also)	None		
	PA1	_____	_____
	PA2	_____	_____
	PA3	_____	_____
8. Burrowing Animals	None		
	BA1	_____	_____
	BA2	_____	_____
	BA3	_____	_____

(1) - Identify defect location (by defect number) on site plan (scale: 1"=100'). If no defects are found, circle "None" in the Defect ID No. column. Utilize a separate sheet, if necessary, to further describe defects and observations of causes .

FIGURE 6-2

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAM

COVER SYSTEM REPAIR REPORT

Repair Date: _____ Repair Personnel:

_____
_____
_____
_____

ITEM	DEFECT REPAIR INFORMATION[1]	
	ID No.	REPAIR DESCRIPTION
1. Surface Cracks (Asphalt)	None	
	AC1	_____
	AC2	_____
	AC3	_____
2. Surface Cracks (Recycled Concrete)	None	
	RC1	_____
	RC2	_____
	RC3	_____
3. Surface Cracks (Vegetative Cover)	None	
	VC1	_____
	VC2	_____
	VC3	_____
4. Surface Material Erosion	None	
	SE1	_____
	SE2	_____
	SE3	_____
5. Vegetation Growth	None	
	VG1	_____
	VG2	_____
	VG3	_____
6. Settlement (Indicate current depth and cumulative depth)	None	
	S1	_____
	S2	_____
	S3	_____
7. Ponding Areas (after rainfall events, identify depth also)	None	
	PA1	_____
	PA2	_____
	PA3	_____
8. Burrowing Animals	None	
	BA1	_____
	BA2	_____
	BA3	_____

(1) - Identify defect location (by defect number) on site plan (scale: 1"=100'). If no defects were found during inspection, circle "None" in the Defect ID No. column. Utilize a separate sheet, if necessary, to further describe defect repairs and observations.

catch basins, pipes and recharge basins. In addition, landfill settlement that may have affected the drainage system will also be noted.

The results of the inspections will be summarized on the Drainage System Inspection Report form shown on Figure 6-3. Maintenance and repair work will be summarized on the Drainage System Repair Report form (Figure 6-4). Locations of the drainage system maintenance work will be shown on a 1"=100' scale site plan. A summary of the results of these inspections will be included in the Annual Summary Report.

6.3 Groundwater Monitoring System

The details for post-closure groundwater monitoring program at on-site and off-site monitoring wells are discussed in Section 4, Groundwater Monitoring System, of this Manual. Groundwater monitoring will be performed on an annual frequency at the selected wells identified under Section 4. Inspections of the groundwater monitoring system will be performed prior to each sampling event. Inspection of the groundwater monitoring system will be summarized on the Groundwater and Gas Monitoring Systems Inspection Report form and the Groundwater Monitoring Well Inspection Check List form shown on Figure 6-5 and 6-5A, respectively. Repair work will be indicated on the Groundwater and Gas Monitoring Systems Repair Report form (Figure 6-6).

Sampling results, inspection results and repair work performed as part of this program will be summarized in the Annual Summary Report.

6.4 Landfill Gas Venting System

The landfill gas venting system will be monitored quarterly throughout the post-closure period as discussed in Section 5. Gas monitoring will be performed at the property line gas vent wells, perimeter gas vent wells and buildings located in the vicinity of the landfill (i.e., the Animal Shelter) for levels of combustible gas. Monitoring data will be recorded on the "Syosset Landfill Quarterly Gas Monitoring Data" form shown on Figure 6-7.

FIGURE 6-3

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAM

DRAINAGE SYSTEM INSPECTION REPORT

Inspection Date: _____

Inspection Frequency:

- ☐ Quarterly
- ☐ Following 5-year Rainfall Event

Inspection Personnel:

_____
_____
_____
_____

ITEM		DEFECT INFORMATION[1]	
	ID No.	DESCRIPTION	OBSERVED CAUSE
1. Ditch Sections	None		
	DS1	_____	_____
	DS2	_____	_____
	DS3	_____	_____
2. Catch Basins	None		
	CB1	_____	_____
	CB2	_____	_____
	CB3	_____	_____
3. Storm Drainage Pipes	None		
	SD1	_____	_____
	SD2	_____	_____
	SD3	_____	_____
4. Recharge Basin Headwalls (Indicate Basin No.)	None		
	RB1	_____	_____
	RB2	_____	_____
	RB3	_____	_____

(1) - Identify defect location (by defect number) on site plan (scale: 1"=100'). If no defects are found, circle "None" in the Defect ID No. column. Utilize a separate sheet, if necessary, to further describe defects and observations of causes .

FIGURE 6-4

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAM

DRAINAGE SYSTEM REPAIR REPORT

Repair Date: _____ Repair Personnel:

_____
_____
_____
_____

ITEM	DEFECT REPAIR INFORMATION[1]	
	ID No.	REPAIR DESCRIPTION
1. Ditch Sections	None	
	DS1	_____
	DS2	_____
	DS3	_____
2. Catch Basins	None	
	CB1	_____
	CB2	_____
	CB3	_____
3. Storm Drainage Pipes	None	
	SD1	_____
	SD2	_____
	SD3	_____
4. Recharge Basin Headwalls (Indicate Basin No.)	None	
	RB1	_____
	RB2	_____
	RB3	_____

(1) - Identify defect location (by defect number) on site plan (scale: 1"=100'). If no defects were found during inspection, circle "None" in the Defect ID No. column. Utilize a separate sheet, if necessary, to further describe defect repairs and observations.

FIGURE 6-5

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAM

GROUNDWATER AND GAS MONITORING SYSTEMS
INSPECTION REPORT

Inspection Date: _____

Inspection Frequency:
- ☐ Quarterly
- ☐ Annually

Inspection Personnel:
_____
_____
_____
_____

ITEM	ID No.	DEFECT INFORMATION[1] DESCRIPTION	OBSERVED CAUSE
GROUNDWATER MONITORING SYSTEM			
1. Well Inspection	None		
	GW1	_____	_____
	GW2	_____	_____
	GW3	_____	_____
2. Pump Inspection	None		
	GP1	_____	_____
	GP2	_____	_____
	GP3	_____	_____
LANDFILL GAS VENTING SYSTEM			
1. Property Line Gas Vent Wells	None		
	PLV1	_____	_____
	PLV2	_____	_____
	PLV3	_____	_____
2. Perimeter Gas Vent Wells	None		
	PV1	_____	_____
	PV2	_____	_____
	PV3	_____	_____
3. Ridge Vent Wells	None		
	RV1	_____	_____
	RV2	_____	_____
	RV3	_____	_____
4. Cluster Monitoring Wells	None		
	CM1	_____	_____
	CM2	_____	_____
	CM3	_____	_____

(1) - Identify defect location (by defect number and monitoring well number or vent number) on site plan (scale: 1"=100'). If no defects are found, circle "None" in the Defect ID No. column. Utilize a separate sheet, if necessary, to further describe defects and observations of causes .

FIGURE 6-5A

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAMING

GROUNDWATER MONITORING WELL INSPECTION CHECKLIST

WELL NO. _____

CHECKLIST FOR INSPECTION OF OUTSIDE OF EXISTING WELLS

	Yes	No	Remarks
1. Cement Seal			
Intact	____	____	_____
Cracked	____	____	_____
Missing	____	____	_____
2. Ponding of Water Around Cement Seal	____	____	_____
3. Protective Steel Pipe & Lock (if used)			
Pipe – Intact	____	____	_____
Lock – Intact	____	____	_____
4. PVC Casing (Stick-up) Straight	____	____	_____
5. Designated Leveling Point Clearly Marked	____	____	_____
6. PVC Cap Vented Properly	____	____	_____
7. Well is Protected	____	____	_____
8. Well is Clearly Marked	____	____	_____

CHECKLIST FOR INSPECTION OF INSIDE OF EXISTING WELLS

1. Bottom of Well from Top of PVC Casing _____
2. Stick-Up _____
3. Bottom of Well Below Grade _____
4. Remarks on Integrity of Casing _____
5. Depth to Water from Top of PVC _____

FIGURE 6-6

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE PROGRAM

GROUNDWATER AND GAS MONITORING SYSTEMS
REPAIR REPORT

Repair Date: _____ Repair Personnel:

_____
_____
_____
_____

ITEM	DEFECT REPAIR INFORMATION[1]	
	ID No.	REPAIR DESCRIPTION
GROUNDWATER MONITORING SYSTEM		
1. Well Inspection	None	
	GW1	_____
	GW2	_____
	GW3	_____
2. Pump Inspection	None	
	GP1	_____
	GP2	_____
	GP3	_____
LANDFILL GAS VENTING SYSTEM		
1. Property Line Gas Vent Wells	None	
	PLV1	_____
	PLV2	_____
	PLV3	_____
2. Perimeter Gas Vent Wells	None	
	PV1	_____
	PV2	_____
	PV3	_____
3. Ridge Vent Wells	None	
	RV1	_____
	RV2	_____
	RV3	_____
4. Cluster Monitoring Wells	None	
	CM1	_____
	CM2	_____
	CM3	_____

(1) - Identify defect location (by defect number) on site plan (scale: 1"=100'). If no defects were found during inspection, circle "None" in the Defect ID No. column. Utilize a separate sheet, if necessary, to further describe defect repairs and observations.

Figure 6-7
Syosset Landfill Quarterly Gas Monitoring Data

Date: _____
Time: _____
Personnel: _____
_____
_____
_____

Temperature: _____ ^{0}F
Barometric Pressure: _____ (R, F, S)
Wind Speed: _____
Wind Direction: _____
Humidity: _____
Weather Data Measured at: _____

Property Line Gas Monitoring Data

Vent Number	Methane (% gas)	Notes
NE1		
NE2		
NE3		
NE4		
NE5		
NE6		
NE7		
NE8		
NE9		
NE10		
NE11		
NE12		
NE13		
NE14		
NE15		
NE16		
NE17		
NE18		
NE19		

Vent Number	Methane (% gas)	Notes
NE20		
NE21		
NE22		
NE23		
SW1		
SW2		
SW3		
SW4		
SW5		
SW6		
SW7		
SW8		
SW9		
NW1		
NW2		
NW3		
NW4		
NW5		
NW6		

Perimeter Gas Monitoring Data

Vent Number	Methane (% gas)	Notes
SE1		
SE2		
SE3		
SE4		
SE5		
SE6		
SE7		
SE8		

Vent Number	Methane (% gas)	Notes
SE9		
AS1		
AS2		
AS3		
AS4		
AS5		
AS6		
AS7		

Animal Shelter Monitoring Data

Bldg. Location	Methane (% gas)	Notes

Bldg. Location	Methane (% gas)	Notes

In addition to the foregoing gas monitoring, the results of gas monitoring performed at property line gas vent wells NE-13 through NE-20, located in the vicinity of the South Grove School, will continue to be submitted to the NYSDEC, USEPA, NYSDOH, NCDH and the SCSD. Gas monitoring at these wells will be conducted on a quarterly basis (during falling barometric conditions, if possible) during the post-closure period in accordance with 6NYCRR Part 360 post-closure provisions. Monitoring data will be recorded on the "Syosset Landfill Combustible Gas Survey at Gas Vent Wells NE-13 through NE-20" form shown on Figure 6-8.

Inspection of the gas venting system will be performed prior to each monitoring event. Inspection and repair work will be recorded on the Groundwater and Gas Monitoring Systems Inspection and Repair Report forms (Figures 6-5 and 6-6, respectively). Gas monitoring results, inspection results and repair work performed will also be summarized in the Annual Summary Report.

Figure 6-8
Syosset Landfill Combustible Gas Survey
At Gas Vent Wells NE-13 Through NE-20

Date: _____

Time: _____

Personnel: _____

_____

_____

_____

Temperature: _____ ^{0}F

Barometric Pressure: _____ (R, F, S)

Wind Speed: _____

Wind Direction: _____

Humidity: _____

Weather Data Measured at: _____

Vent Well Monitoring Data

Vent Number	Methane (% gas)	Notes
NE13		
NE14		
NE15		
NE16		
NE17		
NE18		
NE19		
NE20		

SECTION 7

POST-CLOSURE MONITORING AND MAINTENANCE COSTS

Annual post-closure monitoring and maintenance costs have been developed based on the scope of work established in this Manual. A summary of the initial and annual post-closure monitoring and maintenance costs is provided in Table 7-1 and is discussed in the following paragraphs. All costs were developed using 2003-dollar values.

7.1 Initial Post-Closure Monitoring and Maintenance Costs

The initial post-closure monitoring and maintenance costs include annual cross-sectional surveys at key areas of the site. The total initial post-closure monitoring and maintenance costs are estimated at $18,000 as shown in Table 7-1.

The initial post-closure monitoring will consist of surveys along key cross sections of the site on an annual basis for the first three years of the post-closure period. The estimated survey costs are $18,000. The survey information will be used to determine the extent of potential site settlement during the initial post-closure monitoring period.

7.2 Annual Post-Closure Monitoring and Maintenance Costs

Annual post-closure monitoring and maintenance costs were established for each of components of the landfill closure system discussed in this Manual. The total annual post-closure monitoring and maintenance costs are estimated at $230,000 as shown in Table 7-1. These costs were developed based on the assumptions discussed in the following paragraphs.

The total estimated annual cost for monitoring and maintaining the landfill cover system is $91,000. This cost represents quarterly monitoring and the replacement of 0.5% of the barrier protection layer and 0.1% of the geomembrane/ geotextile layer each year. While repair and/or replacement of portions of the geomembrane/geotextile layer are not anticipated to be required each year, a conservative assumption was made regarding replacement in order to develop an annual maintenance cost.

TABLE 7-1

SYOSSET LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE COSTS

INITIAL POST-CLOSURE MONITORING AND MAINTENANCE COSTS

SURVEY	$18,000
- Annual Cross-Sectional Surveys for First 3 Years of Post-Closure Period	

ANNUAL POST-CLOSURE MONITORING AND MAINTENANCE COSTS

COVER SYSTEM	
- Barrier Protection Layer	$56,000
- Geomembrane/Gas Venting Layer/Geotextile	$35,000
	$91,000
DRAINAGE SYSTEM	$33,000
GROUNDWATER MONITORING SYSTEM	
- Annual Monitoring at Eleven Wells	$50,000
- Well Maintenance	$4,000
	$54,000
GAS VENTING SYSTEM	
- Quarterly Monitoring at Perimeter/Property Line Wells	$14,000
- Well Maintenance	$3,000
	$17,000
ANNUAL SUMMARY REPORT	$35,000
TOTAL ESTIMATED ANNUAL COSTS	$230,000

Annual drainage system monitoring and maintenance costs are estimated at $33,000. This cost represents quarterly monitoring, cleaning existing storm drains and drainage structures, replacing eroded rip-rap and maintenance within the recharge basins.

The estimated annual cost for monitoring and maintaining the groundwater monitoring system is $54,000. This estimate reflects a frequency of annual inspections and sampling for the analytical parameters identified in Section 4 at the eleven groundwater monitoring wells selected for the post-closure monitoring program. Annual maintenance costs are included, but are anticipated to be minor.

The annual monitoring and maintenance cost for the gas venting system is estimated at $17,000. This cost represents quarterly inspection and monitoring of the sites perimeter and property line passive gas venting system. Maintenance costs were included but are anticipated to be minor.

The results of the annual post-closure monitoring and maintenance program will be summarized in an Annual Summary Report in accordance with 6NYCRR Part 360 provisions. The estimated cost for the preparation of each Annual Summary Report is $35,000.

SECTION 8

POST-CLOSURE CONTINGENCY PLAN

This Post-Closure Contingency Plan presents appropriate responses for problems that are reasonably likely to occur during the post-closure period including erosion, differential settlement, and fire. This Plan was prepared in accordance with the provisions of 6NYCRR Part 360-2.15(k)(7)(v).

8.1 Erosion

The vegetative surface of the landfill including drainage ditches will be inspected for erosion damage during the post-closure period in accordance with Section 3, Drainage System, of this Manual. Since site settlement is anticipated to be minimal, erosion due to settlement is also expected to be minimal. All eroded landfill areas will be repaired by filling, grading and revegetating as needed. Eroded drainage ditches will be repaired as required.

8.2 Differential Settlement

In July 1993, a Settlement Study for the former Syosset Landfill was completed by Converse Consultants East, PC which identified potential site settlement and mitigation measures to protect the integrity of the cap. The conclusions of the Settlement Study were that settlement at the site would be minimal in comparison to other landfills and that primary site settlement could be achieved prior to cap construction by performing a Preload Program. Site-specific settlement characteristics obtained during the Settlement Study indicate that maximum settlement over the 30-year post-closure period will be approximately 16 inches.

Monitoring of the cap settlement will be performed by a ground survey at key cross-sectional locations throughout the landfill annually during the first three years of the post-closure period. Visual inspections for other signs of cap settlement including distressed vegetation, wet or ponded areas or improper drainage, and erosion will be performed. To correct minor settlement which may occur and maintain sufficient cap

slopes to promote stormwater runoff, the cap's protective barrier layer will be reshaped by filling where needed as part of the post-closure maintenance program (see Section 2, Cover System, for maintenance of the barrier protective layer).

8.3 Fires

In the event a fire occurs at the site, all personnel will be moved to a safe distance from the area and the Fire Department will be alerted. All other appropriate notifications will be made in accordance with Fire Department and Nassau County Police Department notification procedures.

8.4 Response Action Levels

Monitoring for explosive gas will be performed on a quarterly basis throughout the 30-year post-closure period. If monitoring indicates combustible gas levels greater than 25 percent of the lower explosive limit (LEL) in structures or greater than the LEL at the property boundary (as indicated by a barhole survey), the following actions will be taken:

- the USEPA and NYSDEC will be notified immediately and all steps necessary to ensure safety and human health protection will be taken;
- within 7 days of detection, the methane gas levels encountered and a description of the steps taken to protect human health will be submitted to USEPA and NYSDEC; and
- within 45 days of detection, a plan and schedule to implement a remediation program for the methane gas releases will be submitted to the USEPA and NYSDEC. The implementation of this plan will be performed within 60 days of the date of detection.

APPENDIX A

As Built Plans
For the
Syosset Landfill First Operable Unit Remediation

Preload Program Contract No. DPW 91-560
Capping and Closure Program Contract No. DPW 91-560A

(Bound Separately)

APPENDIX B

USEPA REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (LOW FLOW) PURGING AND SAMPLING
STATEMENT OF WORK

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

I. SCOPE & APPLICATION

This Low Stress (or Low-Flow) Purging and Sampling Procedure is the EPA Region II standard method for collecting low stress (low flow) ground water samples from monitoring wells. Low stress Purging and Sampling results in collection of ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by minimizing stress on the geological formation and minimizing disturbance of sediment that has collected in the well. The procedure applies to monitoring wells that have an inner casing with a diameter of 2.0 inches or greater, and maximum screened intervals of ten feet unless multiple intervals are sampled. The procedure is appropriate for collection of ground water samples that will be analyzed for volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and microbiological and other contaminants in association with all EPA programs.

This procedure does not address the collection of light or dense non-aqueous phase liquids (LNAPL or DNAPL) samples, and should be used for aqueous samples only. For sampling NAPLs, the reader is referred to the following EPA publications: DNAPL Site Evaluation (Cohen & Mercer, 1993) and the RCRA Ground-Water Monitoring: Draft Technical Guidance (EPA/530-R-93-001), and references therein.

II. METHOD SUMMARY

The purpose of the low stress purging and sampling procedure is to collect ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing.

Sampling at the prescribed (low) flow rate has three primary benefits. First, it minimizes disturbance of sediment in the bottom of the well, thereby producing a sample with low turbidity (i.e., low concentration of suspended particles). Typically, this saves time and analytical

costs by eliminating the need for collecting and analyzing an additional filtered sample from the same well. Second, this procedure minimizes aeration of the ground water during sample collection, which improves the sample quality for VOC analysis. Third, in most cases the procedure significantly reduces the volume of ground water purged from a well and the costs associated with its proper treatment and disposal.

III. ADDRESSING POTENTIAL PROBLEMS

Problems that may be encountered using this technique include a) difficulty in sampling wells with insufficient yield; b) failure of one or more key indicator parameters to stabilize; c) cascading of water and/or formation of air bubbles in the tubing; and d) cross-contamination between wells.

Insufficient Yield

Wells with insufficient yield (i.e., low recharge rate of the well) may dewater during purging. Care should be taken to avoid loss of pressure in the tubing line due to dewatering of the well below the level of the pump's intake. Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should therefore be avoided to the extent possible in all cases. Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. Alternatively, ground water samples may be obtained with techniques designed for the unsaturated zone, such as lysimeters.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fails to stabilize after 4 hours, one of three options should be considered: a) continue purging in an attempt to achieve stabilization; b) discontinue purging, do not collect samples, and document attempts to reach stabilization in the log book; c) discontinue purging, collect samples, and document attempts to reach stabilization in the log book; or d) Secure the well, purge and collect samples the next day (preferred). The key indicator parameter for samples to be analyzed for VOCs is dissolved oxygen. The key indicator parameter for all other samples is turbidity.

Cascading

To prevent cascading and/or air bubble formation in the tubing, care should be taken to ensure that the flow rate is sufficient to maintain pump suction. Minimize the length and diameter of tubing (i.e., 1/4 or 3/8 inch ID) to ensure that the tubing remains filled with ground water during sampling.

Cross-Contamination

To prevent cross-contamination between wells, it is strongly recommended that dedicated, in-place pumps be used. As an alternative, the potential for cross-contamination can be reduced by performing the more thorough "daily" decontamination procedures between sampling of each well in addition to the start of each sampling day (see Section VII, below).

Equipment Failure

Adequate equipment should be on-hand so that equipment failures do not adversely impact sampling activities.

IV. PLANNING DOCUMENTATION AND EQUIPMENT

- Approved site-specific Field Sampling Plan/Quality Assurance Project Plan (QAPP). This plan must specify the type of pump and other equipment to be used. The QAPP must also specify the depth to which the pump intake should be lowered in each well. Generally, the target depth will correspond to the mid-point of the most permeable zone in the screened interval. Borehole geologic and geophysical logs can be used to help select the most permeable zone. However, in some cases, other criteria may be used to select the target depth for the pump intake. In all cases, the target depth must be approved by the EPA hydrogeologist or EPA project scientist.

- Well construction data, location map, field data from last sampling event.

- Polyethylene sheeting.

- Flame Ionization Detector (FID) and Photo Ionization Detector (PID).

- Adjustable rate, positive displacement ground water sampling pump (e.g., centrifugal or bladder pumps constructed of stainless steel or Teflon). A peristaltic pump may only be used for inorganic sample collection.

- Interface probe or equivalent device for determining the presence or absence of NAPL.
- Teflon or Teflon-lined polyethylene tubing to collect samples for organic analysis. Teflon or Teflon-lined polyethylene, PVC, Tygon or polyethylene tubing to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.
- Water level measuring device, minimum 0.01 foot accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).
- Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).
- Power source (generator, nitrogen tank, etc.).
- Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephalometer is used to measure turbidity.
- Decontamination supplies (see Section VII, below).
- Logbook (see Section VIII, below).
- Sample bottles.
- Sample preservation supplies (as required by the analytical methods).
- Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

1. Start at the well known or believed to have the least contaminated ground water and proceed systematically to the well with the most contaminated ground water. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations.
2. Lay out sheet of polyethylene for placement of monitoring and sampling equipment.

3. Measure VOCs at the rim of the unopened well with a PID and FID instrument and record the reading in the field log book.

4. Remove well cap.

5. Measure VOCs at the rim of the opened well with a PID and an FID instrument and record the reading in the field log book.

6. If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Note that the reference point should be surveyed for correction of ground water elevations to the mean geodesic datum (MSL).

7. Measure and record the depth to water (to 0.01 ft) in all wells to be sampled prior to purging. Care should be taken to minimize disturbance in the water column and dislodging of any particulate matter attached to the sides or settled at the bottom of the well.

8. If desired, measure and record the depth of any NAPLs using an interface probe. Care should be taken to minimize disturbance of any sediment that has accumulated at the bottom of the well. Record the observations in the log book. If LNAPLs and/or DNAPLs are detected, install the pump at this time, as described in step 9, below. Allow the well to sit for several days between the measurement or sampling of any DNAPLs and the low-stress purging and sampling of the ground water.

Sampling Procedures

9. Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.

10. Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

11. Purge Well: Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water

level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

12. Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

    ±0.1 for pH
    ±3% for specific conductance (conductivity)
    ±10 mv for redox potential
    ±10% for DO and turbidity

    Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

13. Collect Samples: Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.

    Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary. If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Ground water purged from the well prior to sampling can be used for this purpose.

14. Remove Pump and Tubing: After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.

15. Measure and record well depth.

16. Close and lock the well.

VI. FIELD QUALITY CONTROL SAMPLES

Quality control samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. The appropriate EPA Program Guidance should be consulted in preparing the field QC sample requirements of the site-specific QAPP.

All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples should be collected during the sampling event:

- Field duplicates
- Trip blanks for VOCs only
- Equipment blank (not necessary if equipment is dedicated to the well)

As noted above, ground water samples should be collected systematically from wells with the lowest level of contamination through to wells with highest level of contamination. The equipment blank should be collected after sampling from the most contaminated well.

VII. DECONTAMINATION

Non-disposable sampling equipment, including the pump and support cable and electrical wires which contact the sample, must be decontaminated thoroughly each day before use ("daily decon") and after each well is sampled ("between-well decon"). Dedicated, in-place pumps and tubing must be thoroughly decontaminated using "daily decon" procedures (see #17, below) prior to their initial use. For centrifugal pumps, it is strongly recommended that non-disposable sampling equipment, including the pump and support cable and electrical wires in contact with the sample, be decontaminated thoroughly each day before use ("daily decon").

EPA's field experience indicates that the life of centrifugal pumps may be extended by removing entrained grit. This also permits inspection and replacement of the cooling water in centrifugal pumps. All non-dedicated sampling equipment (pumps, tubing, etc.) must be

decontaminated after each well is sampled ("between-well decon," see #18 below).

17. **Daily Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Disassemble pump.

E) Wash pump parts: Place the disassembled parts of the pump into a deep basin containing 8 to 10 gallons of non-phosphate detergent solution. Scrub all pump parts with a test tube brush.

F) Rinse pump parts with potable water.

G) Rinse the following pump parts with distilled/ deionized water: inlet screen, the shaft, the suction interconnector, the motor lead assembly, and the stator housing.

H) Place impeller assembly in a large glass beaker and rinse with 1% nitric acid (HNO_3).

I) Rinse impeller assembly with potable water.

J) Place impeller assembly in a large glass bleaker and rinse with isopropanol.

K) Rinse impeller assembly with distilled/deionized water.

18. **Between-Well Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Final Rinse: Operate pump in a deep basin of distilled/deionized water to pump out 1 to 2 gallons of this final rinse water.

VIII. FIELD LOG BOOK

A field log book must be kept each time ground water monitoring activities are conducted in the field. The field log book should document the following:

- Well identification number and physical condition.
- Well depth, and measurement technique.
- Static water level depth, date, time, and measurement technique.
- Presence and thickness of immiscible liquid layers and detection method.
- Collection method for immiscible liquid layers.
- Pumping rate, drawdown, indicator parameters values, and clock time, at three to five minute intervals; calculate or measure total volume pumped.
- Well sampling sequence and time of sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Field observations of sampling event.
- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.

IX. REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures, EPA/540/S-95/504.